AN INVESTIGATION OF ASSESSMENT METHODS FOR EXAMINING THE PRODUCTION OF REQUESTS FOR INFORMATION BY YOUNG CHILDREN WITH AUTISM SPECTRUM DISORDERS

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This is to certify that I have examined this copy of a doctoral dissertation by

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Abstract

An investigation of assessment methods for examining the production of requests for information by young children with autism spectrum disorders

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This study investigated the use of static assessment (SA) and dynamic assessment (DA) methodologies for examining the production of requests for information (RI) by children with autism spectrum disorders (ASD; N=14) and typically developing peers (TDP; N=12) within their school environment. The effects of manipulating contextual and linguistic variables on production of RI were systematically investigated across five assessment sessions as follows: Static Assessment 1 (SA1) was completed in the classroom with typical objects/activities and no linguistic modifications; SA2 was completed in the classroom with highly-motivating objects/activities and no linguistic modifications; Dynamic Assessment 1 (DA1) was completed in the classroom with highly-motivating objects/activities and use of a linguistic cueing hierarchy to facilitate production of RI; DA2 was completed with a classroom peer in an on-site treatment room with highly-motivating objects/activities and use of the linguistic cueing hierarchy; SA3 mirrored the conditions of SA2. Independent and paired *t*-test comparisons revealed statistically significant differences in production of RI between the TDP group and a subgroup of children with ASD (the ASD group was subdivided into two RI subgroups: high-performers and low-performers). Children in the ASD low-performer subgroup produced significantly fewer RI during SA1 than children in the TDP group and the ASD high-performer subgroup; whereas children in the ASD high-performer subgroup performed similarly to the TDP group. Manipulation of the contextual variable of object/activity choice appeared to influence production of RI; children in ASD low-performer subgroup demonstrated increased production of RI during SA2, when highly-preferred objects/activities were made available in the classroom, as compared to SA1 when typical objects/activities were offered. Comparison of performance across the two physical settings (classroom versus treatment room) revealed no statistically significant differences in production of RI for the TDP group and both ASD subgroups. Results of this study set a benchmark of RI production by typically developing peers from which to compare the performance of children with ASD to determine if the child truly presents with a RI production deficit. Manipulation of contextual and linguistic variables appeared to facilitate increased production of RI by the ASD low-performer subgroup. Clinical implications and future research directions are discussed.

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DEDICATION

To Norah and Corey.

CHAPTER I: LITERATURE REVIEW

John, a five-year eight-month old boy, is introduced to a new child in his Kindergarten classroom. Within five minutes, John is reciting to his new classmate the statistics of the Seattle Sonics' recent basketball season and critiquing the performance of the players. His communication partner is not contributing to the conversation; in fact, to an outside observer, it appears as though John is providing a narrative, rather than participating in a reciprocal conversation. Yet John seems unaware of the unbalanced communication, as well as the nonverbal signals that his new classmate is sending to indicate that she may be bored with the conversation topic; as such, he continues providing an in-depth analysis of the coming year's recruitment prospects. Soon, another peer joins them and the conversation topic switches to discussion of a TV program popular with this age group. While the new classmate appears excited about the conversation, making comments and asking questions about the program's *characters, John becomes silent and gradually moves away from the group to find an independent activity.*

Introduction

John's story illustrates a typical problem for many children with autism spectrum disorders (ASD), that is, difficulty interacting socially with peers. Children with ASD demonstrate social-communicative deficits such as decreased social awareness, limited interest in others and decreased conversational reciprocity with peers, which can result in difficulty developing social relationships.

The current study focused on a particular social-communicative behavior, requests for information (RI). The ability to request information has far-reaching implications with regard to learning about one's environment, demonstrating shared interest with others, and conversational reciprocity. In general, requesting information is an area of need for children with ASD. However, for a subset of this population who demonstrate roughly age-appropriate language and cognitive skills (i.e., more able children with ASD), the RI production abilities are somewhat unclear with conflicting experimental and anecdotal reports regarding use. Indeed, within clinical and education settings, professionals serving more able children with ASD often target increasing the production of RI based on an assumption that these children demonstrate RI production deficits.

To date, the majority of studies that have investigated production of RI have done so within the framework of providing intervention to increase the behavior, rather than assessing the spontaneous production of it. Therefore, an empirical investigation quantifying the production of RI by more able children with ASD, compared to typically-developing peers, is necessary to further inform our understanding of the social-communicative profile of this population.

Another area worthy of investigation is the potential influence of environmental factors on production of RI. Previous research indicates that more able children with ASD demonstrate variable performance across differing environments. As production of RI is contingent upon a number of environmental factors (e.g., availability of communication partner to respond to RI, availability of interesting objects), examination of this behavior demands an assessment methodology that allows for manipulation of environmental factors including contextual and linguistic variables.

Use of dynamic assessment allows for this broad investigation of RI production across environments that include differing physical settings, choice of objects/activities, and linguistic cues. During dynamic assessment, the assessor manipulates environmental variables (contextual and linguistic) for the specific purpose of optimizing the child's performance, allowing for investigation of the influence of environmental factors on performance.

The purpose of this investigation was to quantify the production of RI by more able children with ASD and their typically developing peers and to examine the potential influence of environmental factors (contextual and linguistic variables) on performance. To provide a foundation for this investigation, the following topics are presented: a review of the social-communicative deficits of more able children with ASD; a discussion of requests for information; the influence of environmental factors on social-communicative behaviors; a review of the assessment issues involved in the evaluation of requests for information; and, finally, a presentation of the research questions that were addressed by this study.

The Social-Communicative Deficits of More Able Children with ASD

Autism spectrum disorders (ASD) refer to the spectrum of neurodevelopmental disorders that may impact social, language, cognitive, play, and adaptive functioning skills (Lord & Risi, 2000). This spectrum of disorders is referred to as Pervasive Developmental Disorders (PDD) in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (DSM-IV, American Psychiatric Association, 1994) and includes: autistic disorder, Rett disorder, childhood disintegrative disorder, Asperger disorder, and pervasive developmental disorder - not otherwise specified (PDD-NOS). However, use of the term ASD has been promoted in an effort to recognize the need for intervention services across disorders (Ozonoff, Dawson, & McPartland, 2002), and “acknowledge that there may be few absolute distinctions between broader (ASDs, PDDs) and narrower (autism) definitions” (Lord & Risi, 2000, p. 13).

Returning to John’s vignette, his developmental profile fits within the broad category of a ‘more able’ child with ASD. More able, or high-functioning, individuals with ASD are those who demonstrate generally age-appropriate intelligence and “a fairly good command of language” (Ozonoff et al, 2002, p. 5). Although somewhat controversial, individuals with Asperger disorder (also referred to as Asperger Syndrome [AS]) and individuals with High-Functioning Autism (HFA) are often grouped together with regard to clinical practice (Solomon, Goodlin-Jones, & Anders, 2004; Ozonoff et al, 2002; McAfee, 2001; Twachtman-Cullen, 2001) and may fit the language and cognitive profile of a more able individual with ASD. Children across these diagnoses may present with very similar behaviors and skills (Howlin, 2000; Ozonoff et al, 2002), particularly with regard to social-communicative skills (Rubin & Lennon, 2004; Landa, 2000).

Children with ASD demonstrate decreased social interactions with others (Carpenter & Tomasello, 2000; Volkmar & Klim, 1993; Lord, 1984); they generally do not actively share interest or attention with others, nor respond to others’ attempts to share attention and interest (Carpenter & Tomasello, 2000). Early developmental deficits in joint attention skills may influence social interest and interaction for children with ASD (Travis & Sigman, 1998; Charman, 1998; Carpenter & Tomasello, 2000).

Joint attention deficits have been well-documented in children with ASD and include difficulty with referential looking, declarative pointing and showing, following others’ gaze, and social referencing (Mundy, 1995; Osterling & Dawson, 1994; Sigman, Kasari, Kwon, & Yirmiya, 1992; Baron-Cohen, 1989). From a social-pragmatic view of language development in which “children acquire linguistic symbols as an integral part of their social interactions with adults” (Carpenter & Tomasello, 2000, p. 32), joint attention may be predictive of later pro-social behavior (Sheinkopf, Mundy, Claussen, & Willoughby, 2004) and serves as a building block to language development (Bates, 1976). According to this view, deficits in joint attention can lead to language learning difficulties (Carpenter & Tomasello, 2000; Travis & Sigman, 1998).

Although the role of language in development of social relationships and social interaction is profoundly important (Travis & Sigman, 1998), even children with relatively intact linguistic abilities (such as more able children with ASD) may demonstrate limited social-communicative skills (Landa, 2000). Indeed, “language problems displayed in social interaction… may reflect not a lack of requisite linguistic tools but rather a failure to recognize how such tools can be used to facilitate collaboration or even that there is a need for collaboration” (Abbeduto & Short-Meyerson, 2002, p. 43). Later developing conversational impairments appear to parallel early joint attention deficits; conversations may appear one-sided and more able children with ASD may demonstrate difficulty interpreting their communication partners’ cues (Tager-Flusberg, Paul & Lord, 2005). These deficits may manifest in limited social awareness and interest (Travis & Sigman, 1998).

A bit of a “domino effect” occurs with joint attention deficits impacting communication skills (particularly conversation skills for more able children with ASD), which in turn impact interaction skills, which can limit opportunities to develop social relationships (Travis & Sigman, 1998). For more able children with ASD, social-communicative impairments may manifest as decreased interest in other children, passivity in social interactions, or exclusive interactions around the children’s own highly-preferred interests and/or activities (Barnhill, 2001). Further, their peer relationships may not develop to the same level of intimacy within peer friendships as those of typically-developing peers (Ozonoff et al, 2001). The observation of John’s conversational behavior with his peers certainly fits this description.

Social-communicative deficits may be especially devastating for more able children with ASD, as sometimes the underlying difficulties may go undetected and untreated due to limitations in our testing procedures (Twachtman-Cullen, 2001). Further, “the very strengths observed in more able children may mask their deficits in social understanding and expression and in language comprehension and use” (Twachtman-Cullen, 2001). Because these children demonstrate roughly age-appropriate syntax and semantics skills, they often can produce sophisticated monologues (Marans, Rubin, and Laurent, 2005). However, their social use of language is limited, particularly in regards to interacting with peers, and may adversely affect their ability participate fully in their environment (Ozonoff et al, 2002). Additionally, more able children with ASD may recognize their social-communicative *differences*, leading to feelings of isolation and loneliness (Ozonoff et al, 2002), as well as anxiety (Bellini, 2004) and depression (Ghaziuddin, Weidmer-Mikhail, & Ghaziuddin, 1998; Tantam, 1991). Although they may recognize the differences, they often demonstrate difficulty understanding where the interaction went awry or what social rules they have 'broken' (Ozonoff et al, 2002; Landa, 2000).

As such, when assessing the social-communicative skills of more able children with ASD, one should specifically focus on evaluation of conversation topic flexibility, understanding of others' mental states and communicative intents, communicative reciprocity, and comprehension and use of the rules governing conversations (e.g., turn-taking, topic initiation and maintenance) (Klin, McPartland, & Volkmar, 2005). The current study evaluated more able children with ASD's production of one particular social-communicative behavior, requests for information.

Requests for Information

For children, the ability to request information is vital to learning about their environment and acquiring knowledge (Schwabe, Olswang, & Kreigsmann, 1986). Requesting information is a vehicle for initiating a conversation and provides a means of maintaining the conversation, as well as facilitating communicative reciprocity. Within a conversation, requests for information allow communication partners to express understanding of each other's communicative intents and topic interests. Requesting information is also a means to satisfy curiosity; most people have experienced firsthand, or heard anecdotal accounts, of young children asking question after question (e.g., "Why is the sky blue? Where do spiders come from? How old are you?"), to an unsuspecting adult, who may or may not have the answers. These children may be attempting to satisfy their curiosity about their environment, and the people and objects in it.

Both children with language impairment (Schwabe et al, 1986) and children with ASD demonstrate limited production of requests for information (RI) with both peers and adults (Ozonoff et al, 2002; Koegel, Koegel, Harrower, & Carter, 1999a, Wetherby & Prutting, 1984). Wetherby and Prutting's (1984) seminal study of social and communicative behaviors of young children with ASD provided a profile of performance and development. In comparing communicative behaviors categorized as means to an environmental end (e.g., requests for object, protests) versus communicative behaviors categorized as means to a social end (e.g., requests for information, comments), they suggested "it appears that the autistic child initially acquires the intent to communicate outside the context of social interaction in order to achieve an environmental end" (p. 373). Indeed, the children with ASD in their study did not demonstrate production of even one request for information, while requests for actions and objects were observed.

Some discrepancy seems to exist in the literature regarding the production of RI by more able children with ASD. While two broad reviews of social deficits report limited production of RI by more able children with ASD (Klin et al, 2005; Landa, 2000; Ozonoff et al, 2002), another reports that more able children with ASD “make the same amount of requests of adults as do their typical counterparts” (Gutstein & Whitney, 2002, p. 164). Perhaps more able children with ASD demonstrate a range of performance with regard to RI production, with some children demonstrating few productions and others demonstrating levels of production comparable to their peers. An empirical investigation quantifying the production of RI by more able children with ASD in natural environments (e.g., classroom) could not be found.

Instead, studies to date have investigated social skills treatment packages that included increasing production of RI as one of numerous goals for more able children with ASD (e.g., Thiemann & Goldstein, 2001; Morrison, Kamps, Garcia, & Parker, 2000). Interpretation of these studies is limited however, as opportunities to produce RI may have been limited or RI data were collapsed with requests for object/action (RA/O) data. Although these studies do not provide much insight into the RI production profile of more able children with ASD, the fact that this skill has been included as an intervention goal suggests recognition that this is considered an area of need for this population. Indeed, increasing production of RI is included as a target in a number of suggested intervention packages for more able children with ASD (e.g., McAfee, 2001; Ozonoff et al, 2002)

Based on development of RI in typically developing children, Schwabe and colleagues (1986) proposed that children who demonstrate RI deficits may have difficulties in one, or more, of three constituent skill variables: linguistic skills, cognitive skills, and/or pragmatic skills. They identified the constituent linguistic skills as including: 1) development of the syntactic forms necessary to formulate a Wh-question; 2) acquisition of the semantic forms used in formulating a Wh-question (e.g., what, where, who, why, when…); and 3) comprehension of Wh-questions including the following components: identification of the function of Wh-questions (to solicit a response) and, identification of the semantic category solicited by a particular Wh-question (e.g., a "who" question elicits a response about a person). They suggested the following constituent cognitive skills for production of RI: 1) development of the mental representation of objects and events; 2) recognition of novel or missing information in the environment; and, 3) recognition that communication partners can provide information.

If more able children with ASD do demonstrate RI production deficits, are the deficits due to a lack of social interest in other people or other people's interests? Or, perhaps these children do not have the requisite cognitive skill to understand that production of RI is a means by which to acquire information. Tager-Flusberg (1997) suggests that for children with ASD, "conversational impairments stem from a lack of awareness that people communicate not only to achieve goals but also to exchange information, and indeed, that people may have access to different information" (p. 140).

Another possibility may be that more able children with ASD demonstrate pragmatic deficits that adversely affect their ability to use RI successfully with peers and adults. Constituent pragmatic skill variables include the child's ability to take the listener's perspective, the child's awareness of the listener's background knowledge, and the child's ability to initiate and maintain conversation (Schwabe et al, 1986). More able children with ASD may demonstrate difficulty in one or all of these areas (Baron-Cohen, 1995; Tager-Flusberg, 1997; Ozonoff et al, 2002).

Schwabe and colleagues (1986) also recognized the influence of environmental factors on children's use of RI. They identified the following variables key to the development of RI: "(a) a diversity of interesting objects and experiences; (b) a mature listener who provides answers to the child's information requests; and (c) training and modeling" (1986, p. 46). While these environmental factors are critical for children developing the ability to request information, they may continue to influence production of RI long after the child has acquired other constituent skills. In other words, even children who may have the *ability* to produce RI (competence) may still rely on environmental factors to *demonstrate* their ability to produce RI (performance). Indeed, this may be the case for more able children with ASD.

As indicated above, studies to date (involving children with ASD) have examined production of RI with regard to treatment outcomes. In a case study, Donaldson, Olswang, and Coggins (2002) examined the effects of a hierarchical treatment approach to teaching initiations (including requests for information) to a Kindergarten-age more able child with ASD. Although the child demonstrated increases in production of RI during treatment, he did not maintain this increased performance following withdrawal of treatment. In this study, the average production of RI by the typical peers in the classroom was used to compare the target child's performance. A comparison of the target child's RI production with that of typical peers in the classroom revealed that during both baseline and withdrawal conditions the more able child with ASD demonstrated fewer RI productions than his typical peers. Donaldson and colleagues suggested that opportunity may have played a role in the maintenance of RI production because the study did not include use of elicitation techniques during treatment withdrawal that would have provided opportunities to produce RI.

Different physical settings have also been examined to determine generalization of RI production following intervention (Koegel, Camarata, Valdez-Menchaca, & Koegel, 1998; Hung, 1977); results of these studies provide information regarding the target child's ability to produce requests in non-treated environments, but provide little information regarding how physical environment may influence spontaneous production of RI outside of a treatment model. In an investigation examining the efficacy of a social skills intervention package that included use of requests (RI and RA/O were combined), Morrison and colleagues (2000) manipulated the contextual variable of activity choice, allowing for selection of preferred activities by participants. They found increased levels of social interaction with peers when target children engaged in a preferred game or activity.

Based on the lack of empirical evidence quantifying production of RI by more able children with ASD (as compared to typical peers), the limited opportunity to produce RI and the consolidation of RI behaviors with RA/O behaviors in previous treatment studies, and the limited examination of the role of context in production of RI, further investigation of RI productions by more able children with ASD is warranted.

Environmental Factors

The notion that the environment may affect children's production of RI is not surprising, particularly for children with ASD. At a more general level, research indicates that children with ASD demonstrate varied assessment and intervention outcomes based on environmental factors such as physical setting, adult interaction style, and choice of object/activity. For example, in their review of intervention methodologies, Prizant, Wetherby and Rydell (2001) indicated that adult-driven, one-on-one, discrete trial interventions that employed very specific linguistic models have resulted in acquisition of particular isolated skills, but may also lead to "lack of generalization and communicative spontaneity" (p. 196), whereas more naturalistic approaches within social environments (e.g., enhanced milieu (Kaiser, Yoder, & Keetz, 1992); pivotal response training, (Koegel & Johnson, 1989) have been found to increase language and communication skill generalization.

Use of highly-preferred objects/interests within intervention has also been investigated to determine their influence on performance of social-communicative skills (LeGoff, 2004; Baker, Koegel & Koegel, 1998; Koegel, Dyer, & Bell, 1987). For example, LeGoff (2004) investigated the incorporation of LEGO© building, a highly-preferred activity, into a social skills program intended to improve the social competence of children with ASD. Results indicated the children with ASD achieved statistically significant gains in three measures of social competence after 12 weeks of intervention and sustained after withdrawal of intervention, as compared to controls. LeGoff concluded that "LEGO© play appears to be a particularly effective medium for social skills intervention" (p. 557).

Based on this observed variability for children with ASD, assessment and intervention procedures must consider the role of context on task performance (Kaczmarek, 2002; Landa, 2000; Coggins, 1991). As such, a goal of the current study is to investigate the influence of environmental factors on the performance of more able children with ASD (specifically with regard to their production of RI). The study will manipulate contextual variables (physical setting and choice of object/activity) and linguistic variables (increasingly supportive linguistic cues) during assessment of RI productions. This aligns with McConnell's (2002) recommendations regarding educational best practice for children with ASD "1) Assess social interaction in naturalistic settings, including classrooms and homes, with children and adults as interactive partners; 2) Arrange the environment to prompt and support social interaction" p. 367.

Assessment Issues

More able children with ASD may perform similarly on traditional static or standardized measures of social skills and language; yet are reported to demonstrate a wide range of performance variability within natural social interactions (Ozonoff et al, 2002; Landa, 2000; Donaldson, Olswang & Coggins, 2002). For example, in the case study by Donaldson and colleagues (2002) the child's performance on the Clinical Evaluation of Language Fundamentals – Preschool (Wiig, Secord, & Semel, 1992) revealed age-appropriate receptive and expressive language skills. In addition, teacher report on the Social Skills Rating Scale (SSRS; Gresham& Elliot, 1990) indicated roughly age-appropriate social skills and an average level of problem behaviors (as compared to peers his age). Based on standardized measures, this child presented as age-appropriate with regard to language and social skills. However, observations in the classroom during free-play and snack time revealed that he produced fewer initiations than typically-developing peers (particularly requests for information) and actively avoided social interactions with peers, even when prompted by teachers. Also in contrast to typically-developing peers in his classroom, his conversation initiations were most often directed at adults and conversational topics remained limited to a few highly-preferred topics.

Static Assessment

Static assessment refers to measurement of a child's independent performance at a specific point in time (Lidz, 1991; Brown, Bransford, Ferrara, & Campione, 1983). The child's performance is unaided by the examiner, who acts as a "neutral observer and recorder" (Pena, 1996).

To date, few static assessment measures consider the role of environmental factors on performance, particularly for more able children with ASD. Indeed, "many assessment tools that practitioners customarily employ provide a false sense of security because many of the most popular instruments tap into relatively preserved, discrete skills in more able children, leaving skill areas that are more subtle and complex unnoticed" (Twachtman-Cullen, 2001, p. 226).

Some static standardized assessment measures (e.g., Test of Pragmatic Language, Phelps-Terasaki & Phelps-Gunn, 1992) and static non-standardized measures (e.g., Assessment of Social and Communication Skills for Children with Autism, Quill, Norton Braken, & Fair, 2000) have acknowledged and attempted to address the potential influence of environmental factors on performance by employing use of hypothetical tasks and natural observation. Other measures, such as parent report checklists (e.g., Children's Communication Checklist-2, Bishop,

2003) and observational rating scales (e.g., Pragmatics Profile from the Clinical Evaluation of Language Fundamentals – 4, Semel, Wiig, & Secord, 2003), provide more global information regarding a child's social-communicative skill profile. However, these measures still only record the child's performance at a specific point in time, or provide a general impression of performance. There is limited, if any, manipulation of potentially influencing environmental factors on-line *during* the assessment.

Additionally, few measures specifically address individual social-communicative skills, particularly production of RI. Indeed, regarding the Test of Pragmatic Language, Adams (2002) stated that "if the practitioner wishes to focus on specific pragmatic skills, this test may be too lengthy and a simple elicitation procedure may suffice" p. 976.

As indicated above, the environment profoundly affects production of RI (e.g., Are communication partners available? Is it an appropriate time to produce a RI? Are engaging and interesting objects available that may inspire production of RI?). Thus, static assessment measures may be limited not only in their ability to explore potential performance changes given manipulation of environmental factors, but also may be limited in the type of social-communicative behaviors that are assessed.

Dynamic Assessment

In order to capture the possible influence of the environment on social-communicative performance, one needs an assessment tool that is flexible; a measure that allows for manipulation of not only contextual variables (i.e., physical setting and choice of objects/activities), but also linguistic variables (i.e., the verbal instructions provided during assessment) within a structured framework. Dynamic assessment (DA) may provide a solution to the limitations posed by static assessment measures.

DA is an assessment methodology based on the work of Russian psychologist, Lev Vygotsky (1896-1934), who advocated studying how children's social interactions with others shape their individual development. Rogoff and Wertsch (1984) asserted that Vygotsky's "claim is much stronger than simply that individuals' mental processes develop in the social milieu…(he) views individuals' mental processes as having specific organizational properties that reflect those of the social life from which they derive" (p. 2). As such, Vygostky (1978) suggested that static measures of assessment could not fully describe a child's understanding, as static assessment only measures what the child can perform independently. This independent performance is known as the child's level of actual development (Vygotsky, 1978).

In contrast to the child's level of actual development, the child's level of potential development is measured by his/her performance within a social interaction framework that provides the assistance of a more experienced peer or adult. The distance between the child's level of actual development and level of potential develop defines the child's zone of proximal development (ZPD; Vygotsky 1986/1934).

A child's ZPD may be narrow "indicating that the child is not yet ready to participate at a more advanced level than her or his unaided performance indicates" (Campione, Brown, Ferrara, Jones, Steinberg, 1985, p. 78), while another child's ZPD may be much wider indicating "that, with proper input, the child could be expected to perform much more capably than her or his current level indicates" (p. 78). Thus, the child's level of actual development (as tested by static assessment) provides information about the child's learning *products,* while the child's level of potential development (as tested by DA) provides information about the child's learning *process* (Haywood, Brooks & Burns, 1983; Feuerstein, Hoffman, Rand, & Jensen, 1986; Lidz, 2003).

How does DA tap into the child's learning process? During DA the assessor manipulates the interaction (e.g., contextual and linguistic prompts and cues) for the specific purpose of optimizing the child's performance. As such, the DA provides information regarding the child's ability to benefit from these contextual and linguistic manipulations, including the level and type of support that is needed to facilitate performance (Pena, 1996).

This dynamic approach to assessment has been utilized with a variety of populations in a number of ways (Lidz, 2003). Feuerstein developed a dynamic assessment battery, the Learning Potential Assessment Device (LAPD; Feuerstein, 1979) to assess the cognitive skills of children from diverse cultures entering a new country (e.g., immigrants) and children with developmental disabilities. The 'dynamic goal' of his approach was to "measure the degree of the individual's modifiability by providing him with a focused learning experience... (to) obtain a measure of the individual's learning potential…" (p. 56). In this training-assessment model, a test item is presented and the child's performance is carefully observed to provide information regarding how to proceed with training (the focused learning experience, also known as the Mediated Learning Experience (MLE)). During MLE, Feuerstein follows the learner's responses, offering verbal, tactile, and visual instructions with the intent of developing a particular skill. The expectation of this type of approach would be that child will demonstrate improved performance following training, as compared to his/her initial performance.

Budoff (1987) followed a similar pretest-intervention-posttest format in his learning potential assessment. One major difference between Budoff's approach and that of Feuerstein, was that Budoff's intervention was standardized to allow for consistent comparison across groups, whereas Feuerstein's approach has been viewed as more of a clinical evaluation where "the overall procedure is scripted, but occasionally the interviewer is allowed considerable latitude in addressing student difficulties" (Brown, Campione, Webber, & McGilly, 1992; p. 143). Budoff's intent was to improve diagnoses of children who may have been mislabeled as developmentally disabled due to differing background experiences (i.e., children whose upbringing did not expose them to information assessed by standard psychometric measures).

Campione and Brown's (1987) approach utilizes a graduated prompt procedure that focuses on the individual's ability to learn a specific skill through provision of increasing specific prompts and his/her ability transfer learning to novel situations. In this pretest-posttest format, the purpose of assessment is to determine "how much help is needed to achieve superior performance" (Brown et al, 1992 p. 154).

Finally, Lidz (2003) developed a curriculum-based approach to dynamic assessment during which tasks are taken from a child's classroom, pretest/posttest measures are developed based on the specific task, and intervention following the MLE model and best teaching practices is provided to the child. According to Lidz, this "approach allows optimal individualization and diagnostic exploration" to generate quantitative and qualitative information regarding the child's performance and learning (p. 116).

As can be seen from the previous discussion, DA and its application can come in several forms. Regardless of the specific DA orientation, the environment is manipulated in an effort to improve the child's performance. These environmental variables typically include contextual and linguistic manipulations. With regard to contextual manipulations, the current study allows for investigation of the influence of physical setting (classroom vs. treatment room) within the DA condition and investigation of the influence of object/activity choice within the static assessment (SA) condition. With regard to linguistic manipulations, the current study most closely aligns with Campione and Brown's (1984) graduated prompt procedure in that during the DA condition children were provided with linguistic cues following a cueing hierarchy (least supportive to most supportive) in an attempt to facilitate performance. Similar to the pretest-intervention-posttest formats described above, the current study examined RI productions during SA sessions prior to and following DA sessions; this allowed for investigation of learning over the course of the study to determine if performance improved following DA.

Overall, because DA allows for the manipulation of contextual and linguistic variables that may influence performance, it provides an appropriate framework for examining the influence of the environment on production of RI by more able children with ASD and their typically developing peers. Further, it allows for a glimpse of how these manipulations might affect learning.

Summary

More able children with ASD demonstrate social-communicative deficits that appear to adversely affect their development of social relationships. Of particular interest to the current study is the social-communicative behavior of requesting information. The ability to request information impacts how a child learns about his/her environment, provides an avenue for demonstrating interest in others, and facilitates conversational reciprocity. The RI production abilities of more able children with ASD are somewhat unclear with conflicting reports regarding use, suggesting that more able children with ASD may demonstrate a range of performance. An empirical investigation quantifying the production of RI by more able children with ASD, compared to typically-developing peers, is warranted to contribute to the social-communicative profile of this population.

Previous research indicates that social-communicative behaviors may be influenced by environmental factors. As such, investigation of RI productions within different environments (contextual and linguistic) may allow for a closer examination of the role of the environment on the social-communicative behaviors of more able children with ASD.

Dynamic assessment allows for manipulation of contextual and linguistic variables within the environment, providing an appropriate framework for assessing the production of RI. For the current study, comparison of performance across assessment sessions that vary with regard to contextual variables informs our understanding of the influence of physical setting and object/activity choice on production of RI. Comparison of performance across assessment sessions that vary with regard to linguistic variables provides information regarding the level and type of linguistic cue that may facilitate production of RI.

In addition, comparison of RI productions during the SA condition versus the DA condition provides insight into the learning process of more able children with ASD with regard competence versus performance. In other words, if production of RI increased following DA, that may indicate that more able children with ASD were acquiring or further developing their ability to produce RI (competence). Whereas, if pre-DA performance was similar to post-DA performance, that may indicate that more able children with ASD were already able to produce RI (competence), but may rely on environmental factors to demonstrate this ability (performance).

Research Questions

Again, the purpose of this investigation was to quantify the production of RI by more able children with ASD and their typically developing peers and to examine the potential influence of environmental factors (contextual and linguistic variables) on performance. This was accomplished by systematically manipulating contextual and linguistic variables across two assessment conditions (static and dynamic assessment).

Five major areas of inquiry were investigated as follows: 1) children's overall production of RI (between groups); 2) children's production of RI during SA condition versus DA condition to examine the influence of cueing on productions (within groups); 3) the influence of contextual manipulations (objects/activities and physical setting) during DA on production of RI (within and between groups); 4) the influence of linguistic manipulations during DA on production of RI (within and between groups); and, 5) possible change in production of RI across SA sessions to examine possible change in performance over time (within groups).

Specific research questions within each area of inquiry are presented here.

Question 1: Do more able children with ASD differ from typically-developing peers (TDP) during SA1 with regard to production of RI, as measured by RI production-opportunity ratio (a measure that takes into consideration productions and opportunities) and RI rate (a measure of productions relative to time)?

Question 2: Does production of RI, as measured by RI production-opportunity ratio, during each session of the SA condition (SA1, SA2, SA3) differ from production of RI during the DA condition (DA1 and DA2 combined) within groups?

Question 3a: Does the contextual manipulation of making available highly-preferred objects/activities influence production of RI, as measured by RI production-opportunity ratio, for both groups (within and between groups)?

Question 3b: Does the contextual manipulation of changing physical settings (the classroom vs. the treatment room) influence production of RI, as measured by RI production-opportunity ratio, for both groups (within and between groups)?

Question 4a: Do more children with ASD differ from TDP across DA sessions with regard to average linguistic cueing level necessary to facilitate production of RI, as measured by the session production cueing ratio (a measure that takes into consideration productions relative administered cues)?

Question 4b: During DA, how responsive are more able children with ASD to cues at each linguistic cueing level, as measured by the mean cues provided at each cueing level and the mean RI productions at each cueing level?

Question 4c: For more able children with ASD, during DA, which cueing level appears to be most effective and which cueing level appears to be least effective in facilitating production of RI, as measured by the percentage of cues that resulted in a RI production at each cueing level?

Question 5a: Do more able children with ASD and TDP demonstrate a change in production of RI, as measured by RI production-opportunity ratio, across SA sessions?

Question 5b: Do more able children with ASD and TDP demonstrate a change in unelicited performance, as measured by the free-play RI rate, across SA sessions?

CHAPTER II: METHOD

Participants

A total of 14 more able children with autism spectrum disorder (ASD) and 12 typically developing peers (TDP) participated in the study; all participants were ages 5:0 – 6:11 and enrolled in an integrated Kindergarten or First Grade classroom. Five years of age was selected as the minimum chronological age because typical children demonstrate comprehension and production of a variety of requests for information (RI) by this age (Miller, 1981).

All participants were either enrolled in the Experimental Education Unit (EEU) on the University of Washington campus (ASD N=11; TDP N=11) or the Lake Washington School District (LWSD) (ASD N=3; TDP N=1). The EEU is an inclusive early childhood education center serving both children with and without disabilities (http://depts.washington.edu/eeuweb). LWSD is a public school district serving all children within a geographic area including Kirkland, WA and Redmond, WA. All participants from both settings were enrolled in classrooms that consisted of both children with special needs and typically developing children.

Recruitment: Classroom teachers nominated all participants for the study; consistent with HIPAA requirements, the principal investigator made no contact with potential participants until the family had expressed interest in participating in the study via the teacher. For the ASD group, teachers were instructed to nominate children with a diagnosis of ASD based on school records. Specifically, the children must have received a diagnosis within the spectrum of pervasive developmental disorders (also known as autism spectrum disorders) including: autistic disorder, Asperger Disorder, or Pervasive Developmental Disorder – Not Otherwise Specified according to the DSM-IV criteria. The principal investigator verified documentation of diagnosis through school records and parental report. Teachers were further instructed to nominate more able children with ASD who demonstrated roughly age-appropriate language and cognitive skills, but demonstrated difficulty interacting and verbally initiating (*particularly*, requesting information) in social situations.

For the TDP group, teachers were instructed to nominate children with no history of cognitive, behavioral, and/or communicative difficulties; these children could not have an Individualized Education Plan (IEP) for special education services. In addition, the children were to have demonstrated average performance within the classroom and age-appropriate social skills as judged by the classroom teacher.

For both groups, children who demonstrated aggressive behavior patterns (i.e., hitting, kicking, spitting), and/or hearing or vision loss could not be nominated. Although the investigation did not match specific participants with ASD to typical peers, an effort was made to enroll equal numbers of participants from each group per classroom (e.g., within one classroom enrolling two participants with ASD and two typically developing participants).

Following the criteria described above, EEU classroom teachers nominated a total of 16 more able children with ASD for participation in the study. All 16 families returned a response card indicating their interest in the study to the classroom teacher. The principal investigator then attempted to contact the families to provide additional information regarding the study. One family did not respond to the principal investigator's phone messages; one family's child moved to a different classroom and was no longer interested in participating; one family chose not to participate after learning more about the study; one child did not meet inclusion criteria with regard to language performance; and after speaking with the family, it was determined that one child who was nominated by the classroom teacher was age 7;4, thus outside the age criteria for this study. The remaining 11 families completed informed consent and their children were enrolled in the study. From the LWSD three more able children with ASD were nominated for participation. Following receipt of the families' response cards and phone contact with the principal investigator, all families completed informed consent and enrolled in the study; a total of 14 more able children with ASD enrolled in the study across both EEU and LWSD settings. The mean chronological age of the participants in this group was 6;1 (SD = 5.3 months); ages ranged from 5;5 to 6;10.

Sixteen TDP from the EEU were nominated for participation. Eleven families returned the response card indicating their interest in the study to the classroom teacher. All families were then contacted by the principal investigator and completed informed consent for their children to participate. From the LWSD, four typically developing children were nominated for participation. Three families returned the response card to the classroom teacher and were contacted by the principal investigator. Following the initial phone contact, one family chose not to participate and the remaining two families enrolled in the study; however, one TDP participant was unresponsive to the study procedures (i.e., he expressed discomfort about wearing the microphone; he appeared uncomfortable being videotaped; he stated that he did wish to have any more sessions with the clinician), therefore his family was thanked for their participation and the child was withdrawn from the study. A total of 12 typically developing children enrolled in the study across both EEU and LWSD settings. The mean chronological age for participants in this group was 5;9 (SD = 4 months); ages ranged from 5;3 to 6;7.

Standardized Test Inclusion Criteria: Following nomination by the classroom teacher and enrollment in the study, participants completed an inclusion assessment to determine their further participation in the study. The Clinical Evaluation of Language Fundamentals –Preschool (CELF-Pre) (Wiig, Secord & Semel, 1992) was administered to assess the participant's receptive and expressive language skills. This measure is designed to assess the receptive and expressive language skills of children ages 3;0 to 6;11 on a variety of tasks including: comprehension of linguistic concepts (e.g., next to, before) within one- and two- and three-step oral directions; comprehension of sentence structures (e.g., past tense, passive voice); comprehension of basic concepts (e.g., inside, empty, cold, different); expressive vocabulary; use of morphologic structures (e.g., present progressive, past tense); and repetition of syntactic forms within sentences (e.g., interrogatives, negation).

With regard to production and use of requests for information, although the CELF-Pre does not directly measure a child's spontaneous production of RI, the Recalling Sentences in Context subtest examines the child's delayed imitation production of a number of RI forms (e.g., "What is in there?" "Where did those come from?" "Can I wear these old cowboy boots?"). In addition, the Formulating Labels subtest of the CELF-Pre assesses the child's responses to the "What" question form (e.g., "What is the woman doing?"), while the Sentence Structure subtest of the measure examines the child's comprehension of the "Where" question form (e.g., Where does the boy play baseball?", and the Word Structure subtest assesses comprehension of the "Who" question form (e.g., Who is standing?"). In sum, this measure includes a number of test items that assess the child's production and comprehension of RI.

Either the Test of Nonverbal Intelligence – 3 (TONI-3) (Brown, Sherbenou & Johnsen, 1997) or the matrices subtest of the Kaufman – Brief Intelligence Test

(K-BIT) (Kaufman & Kaufman, 1990) was also administered to assess the participant's nonverbal performance ability. The TONI-3 is designed to assess the abstract/figural problem solving skills of individuals ages 6;0 - 89;11 without using language. The measure uses picture stimuli to evaluate the individual's ability to solve novel, abstract problems. The K-BIT matrices subtest is designed to assess the nonverbal problem solving skills of individuals ages 4;0 - 90;0 by evaluating the individual's ability to perceive visual relationships and complete picture analogies.

To participate in the study, children needed to achieve a score within 1.5 standard deviations of the mean standard score on these measures. On the CELF-Pre, this criterion equates to a Total Language Standard Score of 77-123 (mean=100; SD=15), on the TONI-3 this criterion equates to a quotient standard score of 85-115 (mean = 100; SD = 10), and on the K-BIT this criterion equates to a matrices subtest standard score of 85-115 (mean=100; SD = 10). The principal investigator, a certified speech-language pathologist, administered all inclusion assessment measures.

These criteria were selected to insure that participants demonstrated the syntactic and semantic language skills to communicate verbally with peers, even if they demonstrated difficulty using their language in a socially successful manner. Language and performance IQ levels were also chosen to reduce the potentially confounding variables of low cognition and language abilities on SA and DA performance.

Descriptive Information: The Childhood Autism Rating Scale (CARS; Shopler, Reichler & Renner, 1988) is 15-item behavioral rating scale that was developed to identify children with autism; it is also used to distinguish “children with autism in the mild to moderate range from children with autism in the moderate to severe range” (p. 1). The scale is used to rate children’s behaviors in the following areas: relating to people, imitation, emotional response, body use, object use, adaptation to change, visual response, listening response, taste, smell, and touch response and use; fear and nervousness; verbal communication; nonverbal communication; activity level; and level and consistency of intellectual response.

The CARS was completed for children in the ASD group to provide further descriptive information regarding the participant’s behaviors in the classroom and a measure of the severity of autism. The principal investigator completed the rating scale during two 45-minute observation sessions within the participant’s classroom. The participant’s behavior was observed across free-choice and structured group (e.g., circle time, group work) situations through a one-way mirror. The CARS was not completed for children in the TDP group.

As inclusion of highly-preferred objects/activities was one of the contextual variables that was manipulated in the study, classroom teachers completed the Play

Interest Survey (Quill, 2000) for each participant in both groups. This measure provided information regarding objects/activities for which participants had either demonstrated a strong interest, and/or objects/activities that had served as successful reinforcers within the classroom. Specifically, the survey required teachers to rate the child's interest (1=does not like; 2=shows some interest; 3=likes a lot) in a variety of typical objects/activities across a number of play categories (e.g., exploratory play, manipulatives, physical play, constructive play). The highly-preferred objects and activities employed during the study were chosen based on teacher responses to this survey (i.e., objects/activities that teachers rated as 3).

Table 2.1 describes the inclusion assessment and descriptive measures used in the study.

Table 2.1: Inclusion Assessment and Descriptive Measures

	Task	Measure	How Collected	With Whom
Inclusion Assessment Measures	Standardized language and performance measures	CELF-Pre[1] TONI-3[2] or K-BIT[3]	Administration according to test manuals by principal investigator	Completed for all participants in both groups
Descriptive Information Measures	Standardized assessment measure	CARS[4]	Completion of measure according to test manual by principal investigator	Completed only for participants in the ASD group
	Teacher Survey	Play Interest Survey[5]	Completion of survey form by classroom teacher	Completed for all participants in both groups

[1] Clinical Evaluation of Language Fundamental-Preschool (Wiig, Secord & Semel, 1992)
[2] Test of Nonverbal Intelligence – Third Edition (Brown, Sherbenou & Johnsen, 1997)
[3] Kaufman - Brief Intelligence Test (Kaufman & Kaufman, 1990)
[4] Childhood Autism Rating Scale (Shopler, Reichler & Renner, 1988)
[5] Play Interest Survey (Quill, 2000)

Results of the inclusion assessments and the CARS are presented here. For the ASD group, the mean Total Language Score on the CELF-Pre was 100.78 (SD=13.4) with a range from 77 to 122. For the measures of nonverbal intelligence, the TONI-3 quotient or the K-BIT matrices subtest standard score were used; the mean nonverbal performance score for this group was 104 (SD=9.33) with a range from 85-115. Table 2.2 provides individual age, grade, inclusion assessment standard scores, and descriptive information for each participant in this group.

The TDP group achieved a mean Total Language Score of 104.5 (SD = 8.8) on the CELF-Pre with a range of performance from 91 to 116. Again, the TONI-3 quotient or the K-BIT matrices subtest standard score were used to a measure of nonverbal performance. The mean nonverbal performance score for this group was 99.6 (SD = 7.1) with a range from 87-112. Table 2.3 provides individual age, grade, inclusion assessment standard scores, and descriptive information for each participant in this group.

Independent two-sample *t* tests revealed no statistically significant differences between the ASD group and the typically developing group for CELF-Pre Total Language Scores $t\ (24) = -0.82$, $p = .40$; and nonverbal performance scores $t\ (24) = 1.34$, $p = .19$ on either the TONI-3 or the K-BIT.

The CARS scoring system describes children who receive a rating score of 15-29.5 as “Non-Autistic”, while children receiving a rating score of 30-36.5 are described as presenting with “Mild to Moderate Autism”, and children receiving a rating score of 37-60 are described as presenting with “Severe Autism”. Children in the ASD group achieved a mean rating score of 32.82 (SD = 2.57) with a range of 28-36.5 on this measure. Thus, the mean rating of children in the ASD group fell within the Mild-Moderate descriptive category. Two participants received a rating that corresponds with a descriptor of “Non-Autistic”; however, the CARS authors acknowledge that some children may qualify for a DSM-IV diagnosis within the Pervasive Developmental Disorders spectrum while obtaining a CARS rating below 30. In such a circumstance, “the use of “Mild” or “Moderate” severity specifiers may be appropriate” (p. 14).

In summary, the study included two groups of children ages 5-7 years; one group of more able children with ASD and one group of typically developing peers from the same classrooms. Participants from both groups demonstrated roughly age-appropriate language and nonverbal performance skills (as measured by the CELF-Pre and either the TONI-3 or K-BIT). Participants in the ASD group were nominated by classroom teachers based on limited social interaction skills, particularly with regard to requesting information from others. This group presented with a CARS rating score that fell primarily in the “Mild to Moderate” severity range. Participants in the TDP group presented with no history of developmental and/or behavioral deficits. All participants were enrolled in integrated Kindergarten or First Grade classrooms.

Table 2.2: Inclusion assessment and descriptive information for more able children with ASD (N = 14)

	Age (in years; months)	**Grade and School Site**	**CELF-Pre** (total language score: mean=100; SD=15)	**Nonverbal Measure**	**CARS** (rating score)	**Play Interest Survey** (examples of highly-motivating objects / activities)
1. Male	5;11	K (EEU)	111	106[1]	30	Books, Musical instruments, Dramatic play
2. Male	6;0	K (EEU)	95	107[2]	29.5	Mr. Potato Head, Building blocks, Legos
3. Male	6;7	K (EEU)	98	115[2]	34	Vehicles & roads, Drawing materials, Puzzles
4. Male	6;4	K (EEU)	102	109[2]	34	Legos, Lincoln Logs, Dramatic play
5. Male	5;7	K (EEU)	107	98[1]	32.5	Puzzles, Water table, Art
6. Male	6;6	1^{st} (LWSD)	109	112[1]	30	Marble run, Mr. Potato Head, Puzzles
7. Male	5;5	K (LWSD)	77	93[1]	36.5	Legos, Marble run, Miniature people/animals

[1] Matrices subtest standard score from the Kaufman – Brief Intelligence Test (Kaufman & Kaufman, 1990); mean=100; SD=10

[2] Quotient score from the Test of Nonverbal Intelligence – Third Edition (Brown, Sherbenou & Johnsen, 1997); mean=100; SD=10

Table 2.2 (continued)

8. Male	6;10	1^{st} (LWSD)	115	115[1]	28	Lincoln Logs, Erector sets, Vehicles & roads
9. Male	6;8	K (EEU)	83	92[1]	34.5	Drawing materials, Puppets, Board games
10. Male	6;3	K (EEU)	81	85[1]	35	Tool bench & tools, Marble run, Dress-up
11. Female	5;6	K (EEU)	122	112[1]	32.5	Musical instruments, Drawing materials, Kitchen toys
12. Male	6;4	K (EEU)	113	110[1]	33	Vehicles & roads, Building blocks, Books
13. Female	6;0	K (EEU)	98	103[1]	36	Musical instruments, Dress-up, Cutting & gluing
14. Male	5;11	K (EEU)	100	99[1]	34	Water table, Uno, Legos, Puzzles
Overall Group Means			100.78 (SD = 13.4)	104 (SD = 9.33)	32.82 (SD = 2.57)	

Table 2.3: Inclusion assessment and descriptive information for typically developing peer group (N = 12)

	Age (in years; months)	**Grade and School Site**	**CELF-Pre** (total language score: mean=100; SD=15)	**Nonverbal Measure**	**Play Interest Survey** (examples of highly-preferred objects / activities)
1. Male	5;6	K (EEU)	103	90[1]	Building blocks, Mr. Potato Head, Legos
2. Female	5;6	K (EEU)	93	97[1]	Mr. Potato Head, Building blocks, Dramatic play
3. Male	5;4	K (EEU)	91	106[1]	Building blocks, Mr. Potato Head, Puzzles
4. Female	5;3	K (EEU)	116	113[1]	Dramatic play, Board games, Drawing materials
5. Female	5;9	K (EEU)	115	101[1]	Beads & laces, Books, Painting materials
6. Male	6;0	K (EEU)	110	107[2]	Vehicles & roads, Legos, Marble run
7. Male	5;3	K (LWSD)	105	103[1]	Legos, Vehicles & roads, Drawing materials

[1] Matrices subtest standard score from the Kaufman – Brief Intelligence Test (Kaufman & Kaufman, 1990); mean=100; SD=10

[2] Quotient score from the Test of Nonverbal Intelligence – Third Edition (Brown, Sherbenou & Johnsen, 1997); mean=100; SD=10

Table 2.3 (continued)

8. Male	5;9	K (EEU)	93	87[1]	Drawing materials, Board games, Miniature people & animals
9. Male	5;9	K (EEU)	100	94[1]	Drawing materials, Musical instruments, Building blocks
10. Female	6;2	K (EEU)	106	98[1]	Dramatic play, Musical instruments, Board games
11. Male	6;5	K (EEU)	114	100[1]	Building blocks, Board games, Puzzles
12. Male	6;0	K (EEU)	108	99[1]	Drawing materials, Puzzles, Dress-up
Overall Group Means			104.5 (SD = 8.77)	99.58 (SD = 7.07)	

Setting and Materials

All procedures were completed within the participant's school environment. The inclusion assessment measures (i.e., CELF-Pre, TONI-3, K-BIT), and one dynamic assessment condition (DA2) were administered in a small, quiet room on the school campus (e.g., treatment room). All other assessments were completed within the child's classroom during the free-choice portion of the school day. The principal investigator administered all inclusion assessment measures and both SA and DA conditions.

All SA sessions and one DA session were completed in the participant's classroom during the free-choice portion of the regular school day. In all classrooms, free choice was the period of the day during which children were able to self-select activities from a variety of activities provided by the classroom teacher. All classrooms had a number of different areas that were designated for particular activities (e.g., art, dramatic play, construction, reading); children were allowed to move freely from one activity to another and engage with any peer in the classroom.

One DA session was completed out of the participant's classroom. At the EEU, these sessions were completed in a treatment room located near the classroom. The treatment room contained a child-sized table and chairs to accommodate the participant, a classroom peer, and the principal investigator. The principal investigator supplied the objects/activities, as these were not typically stored within the room. At the LWSD sites, an empty classroom or treatment room was used during this DA session. Again, a table and chairs were in the room and the principal investigator supplied the objects/activities.

As indicated above, object/activity choice was one of the variables manipulated across the SA and DA conditions. In an attempt to maintain a natural environment, teachers were given no specific instructions with regard to *limitations* of particular objects/activities that were typically made available during free choice. Rather, during assessment sessions that were designed to include highly-preferred objects/activities (SA2, DA1, DA2, SA3), the principal investigator ensured that highly-preferred activities were *included* as free-choice options. Thus, objects/activities that may have been readily available during typical free-choice times (including SA1) may have also constituted a highly-preferred object/activity for a child.

Analysis of object/activity choice across participants revealed that only one participant (participant #8 with ASD) engaged with highly-preferred objects/activities during SA1. Across all sessions that included highly-preferred objects/activities (SA2, DA1, DA2, SA3), more able children with ASD engaged with objects/activities that the teacher identified as highly preferred 99.97 percent of the sessions. TDP engaged in such activities 99.98 percent of the sessions.

General Procedures

The study included two components: 1) static assessment (SA) and 2) dynamic assessment (DA). The static assessment (SA) condition included collection of three separate language samples (SA1, SA2, SA3) of the participant's interactions with peers and materials within the classroom. Two SA sessions (SA1, SA2) were administered prior to the DA sessions. The third SA session (SA3) was administered following the DA sessions (i.e., at the end of the study). During the SA condition, the contextual variable of object/activity choice was manipulated; SA1 included typical objects/activities while SA2 and SA3 included availability of highly-preferred objects/activities.

Across all SA sessions, each participant was provided with at least 8 opportunities to produce RI. Across all sessions (SA & DA), a RI was defined as a demand or question requiring only information from a peer or adult (e.g., "How are you?" "What's that?" "How do I make this?") Therefore, requests for action (e.g., "Will you push me in the wagon?") and/or requests for object (e.g., "Can I have the red crayon?") were not considered RI. As these were all static assessment conditions, the principal investigator did not provide any modeling, cueing, or feedback regarding production of RI. Further information regarding SA1, SA2, and SA3 is provided below under Specific Procedures.

Also during this static assessment phase, the primary investigator completed the <u>CARS</u> (Shopler et al, 1988) based on at least two observations of the participant within his/her classroom. And the participant's classroom teacher completed the Play Interest Survey (Quill, 2000) to assist in determining which highly-preferred objects/activities would be made available during the SA2, SA3, and both DA sessions.

The DA component included collection of two separate language samples (DA1, DA2) of the target child's interactions with peers and the primary investigator both in and out of the classroom. During both DA sessions, the principal investigator manipulated linguistic variables by providing cues along a linguistic hierarchy to facilitate production of RI. The contextual variable of physical setting was manipulated across the dynamic assessment phase; DA1 was completed within the participant's classroom, while DA2 was completed in an on-campus treatment room. For the DA condition, the contextual variable of object/activity choice remained constant; both DA sessions included availability of highly-preferred objects/activities. As with the static assessment language sample conditions (SA1, SA2, SA3), the participants were provided with at least 8 opportunities to produce RI. Further description of DA1 and DA2 is presented below under Specific Procedures.

Table 2.4 details the administration of each of the five language sample assessment conditions (SA1, SA2, DA1, DA2, and SA3). This table indicates the order of the assessment sessions, and the way in which contextual (object/activity choice; physical setting) and linguistic variables were manipulated across sessions.

Please note that the order of DA1 and DA2 administration was counterbalanced across all participants to reduce possible order effects on performance. At least one week separated each session (SA1, SA2, DA1, DA2, SA3), with a range of one to three weeks between sessions based on school schedules and child illness.

Table 2.4: Environmental Factors associated with SA and DA conditions

Environmental Factors	Session Order				
	1) SA1	**2) SA2**	**3 or 4) DA1**	**3 or 4) DA2**	**5) SA3**
Contextual Variables *(object / activity choice;* physical setting*)*	*Typical* objects / activities within classroom	*Highly-preferred* objects / activities within classroom	*Highly-preferred* objects / activities in peer dyad within classroom	*Highly-preferred* objects / activities in peer dyad in treatment room	*Highly-preferred* objects / activities within classroom
Linguistic Variables	No linguistic prompts Typical classroom interactions with peers and adults		1. No linguistic prompts (e.g., natural interactions among target child, peers & teachers) 2. Adult or peer model (e.g., "What are you building?" – addressed to target child) 3. Adult indirect cue (e.g., "You could ask Billy what he is building" – statement addressed to target child playing with peer 'Billy') 4. Adult direct cues (e.g., "Say 'what are you building Billy?'" – directive addressed to target child playing with peer 'Billy')		No linguistic prompts Typical classroom interactions with peers and adults

Specific Experimental Procedures

Static Assessment Phase: Data Collection

As indicated above, the static assessment phase of the study included completion of three static assessment sessions (SA1, SA2, and SA3). A number of factors were consistent across all three static assessment conditions. All three included a static language sample collected within the participant's classroom during the free-choice period of the school day. For the first five minutes of each session, the principal investigator did not interact with the target child; after attaching the wireless lavaliere microphone on the child's clothing, he/she was instructed to "Go play". Following this initial five-minute "free play" period, the principal investigator joined the target child in play, encouraging the participant to include his/her peers in the interaction. During this time, the principal investigator presented a variety of elicitation techniques designed to provide opportunities for the target child to produce RI; these were in addition to the natural opportunities already inherent in the interaction. Participants were provided with at least 8 opportunities to produce RI. Opportunities were either natural or elicited.

Natural opportunities included the target child's spontaneous RI productions (Bain & Olswang, 1995), spontaneous peer models, and 'contextually relevant' opportunities. Spontaneous RI production opportunities referred to the participant's natural production of a RI with no prompts or models from either adults or peers.

Spontaneous peer model opportunities referred to RI produced by the participant's peers that were contextually appropriate and relevant to the activity and topic of conversation. These RI productions were those that the target participant had an equal opportunity to produce given the context and conversation. For example, during a Lego building activity with the participant, a peer, and the principal investigator, if the participant's peer asked the principal investigator "What are you building?" this was considered a spontaneous peer model opportunity because it would have been equally appropriate for the participant to request this information from the principal investigator. However, if a peer made a RI that was not contextually appropriate (e.g., a peer sitting on the periphery of the Lego group working on an art project asking "Where is the brown marker") and/or a RI to which the participant already had the information (e.g., a peer entering the Lego activity in which the participant was already participating and asking "What are you guys doing?"), this was not considered a spontaneous peer model opportunity.

Contextually relevant opportunities referred to opportunities during which a situation occurred within the interaction context that would require further information to proceed with the activity. For example, while playing the game Twister in the classroom, the teacher announced where the children were to place their hands and feet based on the results of a spinner. Should the teacher withhold announcing the results of the next spin, thus interrupting the game, one would expect a typically developing child to produce a RI regarding the outcome of the spin. A request for help, or a request to have the teacher perform the action was not considered a RI.

Elicited opportunities involved the use of elicitation techniques by the principal investigator to systematically manipulate materials with the intention of creating opportunities for the production of a RI (Landa & Olswang, 1988). Use of elicitation techniques to create RI opportunities is supported by Roth and Spekman's (1984) statement, "The mere absence of a particular communicative intent or failure to initiate new topics cannot necessarily be construed as an indication that such a skill is not part of a child's repertoire. …although a child may evidence a particular communicative behavior, it may not be demonstrated with sufficient frequency to assess it adequately. To compensate for these problems, it may be necessary to supplement naturalistic observations with more structured evocation procedures." (p. 12).

Prior to initiating the current study, the principal investigator investigated the responses of both typically developing children (n = 12) and children with special needs (n = 8) to ten different elicitation techniques. These techniques were piloted to determine their effectiveness in eliciting RI productions. Four techniques were excluded from this study based on poor and/or inconsistent responsiveness from the children. The pilot data indicated that the remaining six techniques were consistently successful in eliciting RI from all children; thus, they were included in the current study. As described below, these techniques did not include any verbal prompts or cues to assist the child in producing a RI. The following elicitation nonverbal techniques were used:

1. *Box elicitation* during which the child is presented with a box containing an object of interest. The principal investigator gains the child's attention, shakes the box, and places it in front of him/her. An expected response to this elicitation might be "What's in the box?"

2. *Missing Piece Elicitation* during which the child is presented with an multi-piece activity (e.g., a puzzle). The child engages in the activity with a peer and/or adult and the principal investigator withholds or hides one piece of the activity. An expected response to this elicitation might be "Where is the piece?"

3. *Irrelevant Object Elicitation* during which the child is presented with a game or activity that contains an irrelevant object (e.g., a crayon box with a pair of scissors inside). The principal investigator instructs the child to open the game/activity and if the child does not appear to see the irrelevant object the PI points to the object and looks at the child. An expected response to this elicitation might be "What's that doing in here?" or "Why is that here?"

4. *Envelope Elicitation* during which the child is presented with an envelope or bag decorated with stickers containing an object of interest. The principal investigator gains the child's attention, looks inside the envelope/bag, looks at the child, and the envelope/bag is placed in front of the child. An expected response to this elicitation might be "What's in there?"

5. *Object of Interest Elicitation* during which the principal investigator hides an object of interest. The principal investigator observes the child to determine with which object the child is engaged, when the child is not attending to the object the principal investigator hides the object. An expected response to this elicitation might be "Where is the _______?" or "What happened to the ___________?"

6. *Manipulation Elicitation* during which the child is presented with an object that requires some kind of manipulation to make it work successfully (e.g., a wire maze that becomes a planet). This object may be used in combination with one of the aforementioned elicitation objects (e.g., the object may be inside the envelope presented in the envelope elicitation). An expected response to this elicitation might be "How does this work?"

The contextual variable of object/activity choice was manipulated during the SA condition. Specifically, SA1 included availability of typical objects/activities that were readily available during free choice time. In other words, no modifications to object/activity availability were made during SA1. The SA2 session included availability of highly-preferred objects/activities based on classroom teachers' responses to the Play Interest Survey. The SA2 session was completed following SA1, prior to any of the DA sessions. Although the contextual variable of object/activity choice was manipulated during SA2, the target's child's production of RI was unaided by the principal investigator; no prompts or cues were provided to facilitate performance during this static assessment session. Finally, SA3 included availability of highly-preferred objects/activities, much like SA2; however it was completed following both DA sessions to determine if learning had occurred across the five assessment sessions. The contextual variable of physical setting was not manipulated during the SA condition; all SA sessions were completed in the participant's classroom during the free-choice period of their day.

No particular linguistic constraints were placed on the teachers or the principal investigator during all SA sessions; the interactions were to be as natural as possible for a free play/language sample. The principal investigator actively avoided production of RI during all SA conditions in an attempt to reduce the participant's exposure to RI models. Throughout all three SA sessions, the principal investigator did not provide any verbal cueing, modeling, and/or feedback to the participant with regard to RI.

For each participant, all SA (and DA) sessions were separated by at least one week, with a range of one to three weeks between sessions (due to participant illness, school vacations, field trips, etc.). After completing the inclusion assessment, most children from both groups were actively participating in the study (SA and DA sessions) for five to six weeks (range of five weeks to eight weeks).

Dynamic Assessment Phase: Data Collection

The dynamic assessment phase consisted of two dynamic assessment sessions (DA1 and DA2). Both sessions were videotaped for later coding of the participants RI productions. As indicated above, during both DA sessions the principal investigator provided linguistic cues to facilitate production of RI. This hierarchy was provided at each opportunity, both natural and elicited, (as defined above) for a RI. The cueing hierarchy progressed as follows: 1) Spontaneous: no cue was provided and the participant was given time to produce a spontaneous RI (e.g., presentation of the box elicitation described above with no verbal model or prompt; same as during SA sessions); 2) Model: if the child did not produce a RI, then an adult or peer model of a RI was provided (e.g., "What's in the box?"); 3) Indirect cue: if the child did not produce an RI, then an indirect cue was provided (e.g., "You could ask me what's in the box."); finally, 4) Direct cue: if the child did not produce a RI, then a direct cue was provided (e.g., "Say, 'Amy, what's in the box?'").

In addition to manipulating linguistic variables during the DA sessions, contextual variables were also manipulated to determine possible effects of changing the setting. As such, DA1 was completed in the child's classroom using highly-preferred objects/activities, while DA2 was completed in a treatment room on the child's school campus. Prior to leaving the classroom for DA2, the participant was instructed to find a peer to join the session. The order of DA1 and DA2 administration was counterbalanced across participants to minimize possible order effects.

Similar to the SA conditions, during both DA sessions the participant was given five minutes of "free play" period, during which time the principal investigator provided the linguistic cues as necessary, but did not present any elicitation opportunities. Following this initial five minutes, elicitation opportunities were provided to insure that participants had at least 8 opportunities to produce RI during each session.

Data Reduction: Experimental Measures

Data reduction includes coding and measures. The data were coded to capture the children's productions of RI under two different conditions (SA and DA). Recall that across all measures, a RI was defined for coding as a demand or question requiring only information from a peer or adult (e.g., "How are you?" "What's that?" "How do I make this?") In other words, requests for action (e.g., "Will you push me in the wagon?") and/or requests for object (e.g., "Can I have the red crayon?") were not considered RI. A RI was coded when it met the following criteria: 1) the RI occurred when a participant demonstrated a RI upon entering a new peer group; *or* 2) a RI was produced following 3 seconds of non-interaction between ongoing interactions when already in close physical proximity to peer(s) or adults; 3) echolalic speech was not considered a RI attempt (Koegel, Koegel, Shoshan, & McNerney, 1999b). See Appendix A for operational definitions of all codes and further examples of RI productions and Appendix B for an example of the coding sheet used for both SA and DA conditions.

SA Condition. The SA1 session provided information regarding each participant's production of RI within his/her classroom given no modifications to the availability of objects/activities, while SA2 and SA3 provided information regarding each participant's performance when the contextual factor of object/activity choice was manipulated (when highly-preferred objects/activities were made available). Throughout the SA condition, linguistic variables remained constant; no verbal cueing or prompting was provided with regard to RI performance. Coding of the SA sessions included counting the frequency of occurrence of all RI produced within the session (including the first five minutes of "free play"). These data provided the ratio of RI productions per opportunity (*RI production-opportunity ratio*) and the rate of RI productions per minute (*RI rate*) produced by the participant during the session. The RI production-opportunity ratio was calculated by dividing the total number of RI productions during the session by the total number of RI opportunities within the session. The RI rate was calculated by dividing the total number of RI productions during the session by the length of the session (in minutes). These ratios and rates were compared between groups and within groups for all SA sessions as described in the Data Analysis section.

Frequency of occurrence of all RI productions during only the first five minutes of the SA sessions (i.e., the "free-play" portion of the session prior to presentation of elicitation opportunities) was also counted separately. The total number of RI productions during the free-play portion of a session was divided by five minutes, providing a *"free-play" RI rate*.

As aforementioned, a previous study by Donaldson and colleagues (2002) reported that typically-developing Kindergarten-age children produced RI at an average rate of .19 per minute (or approximately one RI every five minutes) during free-choice time in the classroom. Therefore, this RI rate of .19 was used as a comparison point for the SA1 free-play RI rates in the current study. Each participant's free-play RI rate for SA1 was calculated and compared to the .19 average RI rate. For the TDP group, the comparison was made to ensure that the TDP participants were producing RI at a rate at, or above, that expected of typically-developing children within the classroom. For the ASD group, the .19 RI rate provided a separation point for dividing the group into high-performer and low-performer subgroups; participants with ASD who produced a free-play RI rate during SA1 that was greater than .19 were included in the ASD-HI group, while participants with ASD who produced a free-play RI rate during SA1 that was less than .19 were included in the ASD-LOW group. Division of the ASD group into HI and LOW subgroups allowed for more detailed analysis of the possible effects of contextual and linguistic variable manipulations on performance. Further description of the ASD subgroups is provided in the Data Analysis section below.

DA Condition. Each DA session was coded for the participant's production of RI at each level of the cueing hierarchy. Frequency of production of RI at each level for each session was calculated. DA data were further reduced to determine the RI production-opportunity ratio and the RI rate (as defined above) produced by the participant. These ratios and rates were compared between groups and within groups for both DA sessions.

In order to investigate the cueing level necessary to facilitate production of RI, a *total session cued score* for each DA session was calculated. All cue levels were assigned a value of one. The values up to and including the cue level provided for each opportunity were then summed to yield a *cued score* for each RI opportunity. For example, if a child produced a RI after receiving three levels of cueing (spontaneous, model, and indirect cue), he/she achieved a cued score of 3 for that opportunity. All cued scores were then summed across the session to provide a total session cued score for each session. The total session cued score was then divided by the number of RI produced during the session to provide a *session production cueing ratio*. Table 2.5 provides an example of this coding and scoring method.

Table 2.5: Hypothetical example of coding and scoring for the *session production cueing ratio*

	1. Spontaneous	**2. Model**	**3. Indirect Cue**	**4. Direct Cue**	*Cued Score*
Opportunity 1	✓ •	✓	✓	*	*4*
Opportunity 2	✓	*			*2*
Opportunity 3	*				*1*
Opportunity 4	✓	✓	✓	✓	*4*
	Total session cued score:				*11*
Session Production Cueing Ratio (total session cued score/ total # of RI productions within the session):					**11/3=3.66**

✓ Cue provided; participant did not produce a RI
* Cue provided; participant produced RI at this cueing level hierarchy

Table 2.5 depicts a hypothetical example of RI coding and scoring during a DA session. Each cue is coded and a cued score is calculated for each RI opportunity. In this example, for opportunity 1, the participant required cueing to level four of the hierarchy before producing a RI, thus achieving a cued score of 4 (1+1+1+1=4) for that opportunity. To determine the *session production cueing ratio*, the total session cued production score (11) was divided by the total number of RI *productions* (3), resulting in a session production cueing ratio of 3.66. Again, the session production cueing ratio provides information regarding the average cueing level necessary to facilitate production of RI during a session

To investigate participants' responsiveness to different cueing levels within the cueing hierarchy, frequency of occurrence of all cues provided at each level of the cueing hierarchy (1: spontaneous; 2: peer or adult model; 3: indirect cue; 4: direct cue) was counted separately. Frequency of occurrence of all RI productions at each level of the cueing hierarchy was also counted.

To investigate the effectiveness of each cueing level of the cueing hierarchy at facilitating production of RI, each participant's percentage of cues resulting in RI productions was calculated. This percentage was calculated by dividing the frequency of occurrence count of RI productions at each cueing level by the frequency of occurrence count of the number of cues provided at each cueing level. Table 2.6 provides an example of the frequency counts and the calculation of percentage of cues resulting in RI productions.

Table 2.6: Hypothetical example of frequency counts and percentage of cues resulting in RI productions

	1. Spontaneous	2. Model	3. Indirect Cue	4. Direct Cue
Opportunity 1	✓ •	✓	✓	*
Opportunity 2	✓	*		
Opportunity 3	*			
Opportunity 4	✓	✓	✓	✓
Frequency of occurrence of cues provided at each cueing level	*4*	*3*	*2*	*2*
Frequency of occurrence of RI productions at each cueing level	1	1	0	1
Percentage of cues resulting in RI productions	1 / 4 = 25%	1 / 3 = 33%	0 / 2 = 0%	1 / 2 = 50%

✓ Cue provided; participant did not produce a RI
* Cue provided; participant produced RI at this cueing level hierarchy

Table 2.6 depicts the same hypothetical example that was used in Table 2.5; however, for this example only frequency of occurrence data will be calculated. To determine the frequency of occurrence of cues provided at each cueing level, all cues provided within one cueing level were summed across all opportunities. In this example, for cueing level 2, three cues were provided at this cueing level across all opportunities; thus, summing all cues equates to a frequency of occurrence count of 3. To determine the frequency of occurrence of all RI productions at each cueing level, all RI productions at each cueing level were summed across all opportunities. In this example, for cueing level 2, the participant produced one RI at this cueing level, as there were no other RI productions at this cueing level, the frequency of occurrence count of RI productions for this level equals 1. For this example, to determine the percentage of cues resulting in a RI production for cueing level 2, divide the frequency of occurrence count of RI productions at cueing level 2 (1) by the frequency of occurrence count of cues provided at cueing level 2 (3) and multiply by 100. The percentage of cues resulting in RI productions for cueing level 2 equals 33%.

Table 2.7 summarizes all study tasks and RI measures per session for SA and DA conditions, as described above.

Table 2.7: Tasks and measures

	Task	RI Measures Per Session	How Collected
Static Assessment	SA1, SA2, SA3	*RI production-opportunity ratio*: Total # of RI productions during session / # RI opportunities during session *RI Rate*: Total # of RI productions during session / Length of session in minutes *Free play RI rate*: # of RI productions during 'free play' portion of session / Five minutes	Principal investigator coded behaviors from video recordings
Dynamic Assessment	DA1, DA2	Same as SA condition *Session production cueing ratio:* Total session cued score (total number of cues provided during session) / Total # of RI productions during session Frequency of occurrence of cues provided at each cueing level Frequency of occurrence of RI productions at each cueing level Percentage of cues resulting in RI productions: (frequency of occurrence of RI productions at each cueing level / Frequency of occurrence of cues provided at each cueing level) multiplied by 100	Principal investigator coded behaviors from video recordings

Reliability

Procedural and measurement reliability was completed for all RI tasks and measures. Procedural reliability was completed for 20% of all SA and DA procedures following Billingsley, White & Munson (1980) to ensure that assessment protocols were administered consistently across all participants and all conditions. Using the videorecordings of the SA and DA sessions, the actual assessment administration was compared with the planned assessment administration by two trained observers. Both trained observers were post-baccalaureate students in the Department of Speech and Hearing Sciences at the University of Washington who completed six hours of training with the principal investigator before independently completing procedural reliability coding. Procedural reliability results were as follows: provision of at least eight RI opportunities during SA and DA reliability sessions with 99% accuracy; provision of linguistic cues during DA reliability sessions with 94% accuracy; and provision of elicitation techniques during SA and DA reliability session following protocol with 100% accuracy.

To assess measurement reliability, two trained independent raters coded 25% of all sessions across participants and conditions. Both raters were certified speech-language pathologists and doctoral students in the Department of Speech and Hearing Sciences at University of Washington. Raters completed at least 10 hours of training and achieved at least 80% reliability with the primary coder (the principal investigator) before independently coding assessment sessions. Agreement between coders was examined for the number and type (natural or elicited) of RI opportunities and the target child's production of RI, as well as, the level of cueing provided along the linguistic cueing hierarchy. Intercoder agreement was determined using Cohen's Kappa, a statistic that considers chance agreement within the total proportion of agreement (Hollenbeck, 1978). A Cohen's Kappa coefficient of .77 (range = .69 to .92) was achieved between the primary and secondary coders for the number of RI opportunities and RI productions, and a Cohen's Kappa coefficient of .81 (range = .73 to .94) for the cueing hierarchy. Kappa values above .70 are considered good inter-observer agreement (Cicchetti and Sparrow, 1981).

Data Analysis

The purpose of this investigation was to quantify the production of RI by more able children with ASD and their typically developing peers and to examine the potential influence of environmental factors (contextual and linguistic variables) on performance. The methods used in this study allowed for examination of RI productions across two assessment conditions (SA and DA).

Data analysis was designed to explore five major areas of inquiry as follows: 1) children's overall production of RI (between groups); 2) children's production of RI during SA condition versus DA condition to examine the influence of cueing on productions (within groups); 3) the influence of contextual manipulations on production of RI (within and between groups); 4) the influence of linguistic manipulations on production of RI (within and between groups); and, 5) possible change in production of RI across SA sessions to examine possible change in performance over time (within groups).

In an effort to capture an accurate picture of the potential range of performance by more able children with ASD, no limits were set with regard to their production of RI prior to the initiation of SA and DA assessments. In other words, although classroom teachers reported that the children with ASD demonstrated difficulty producing RI and engaging in social interactions in general; their actual production of RI was not quantified prior to completion of the SA1 session. This was intentional to allow for a view of actual production of RI by children with ASD in comparison to TDP.

Analysis of RI productions, as measured by free play RI rate during SA1 revealed that more able children with ASD demonstrated a wide range of performance. As such, analysis of data with regard to the responsiveness of children with ASD to contextual and linguistic manipulations needed to take into account the variability of performance within the ASD group. That is, one might assume that children who produce more RI might benefit differently from the contextual and linguistic variable manipulation than children producing fewer RI. Therefore, as indicated above, the ASD group was divided into a high performer ASD (ASD-HI) subgroup (children with ASD who demonstrated a free-play RI rate of .19 or above during SA1) and a low performer ASD (ASD-LOW) subgroup (those children with ASD who demonstrated a free-play RI rate of .19 or below during SA1). Performance was then compared within ASD subgroups and between the TDP group and ASD subgroups.

To orient the reader to the characteristics that describe the two ASD subgroups, Table 2.8 provides a review of the inclusion assessment and descriptive information for the ASD-HI subgroup. Table 2.9 provides a review of the inclusion assessment and descriptive information for the ASD-LOW subgroup.

Table 2.8: Inclusion assessment and descriptive information for the ASD-HI subgroup (N = 6)

	Age (in years; months)	**Grade and School Site**	**CELF-Pre** (total language score: mean=100; SD=15)	**Nonverbal Measure**	**CARS** (rating score)	**Play Interest Survey** (examples of highly-motivating objects / activities)
6. Male	6;6	1^{st} LWSD	109	112[1]	30	Marble run, Mr. Potato Head, Puzzles
7. Male	5;5	K LWSD	77	93[1]	36.5	Legos, Marble run, Miniature people/animals
8. Male	6;10	1^{st} LWSD	115	115[1]	28	Lincoln Logs, Erector sets, Vehicles & roads
12. Male	6;4	K EEU	113	110[1]	33	Vehicles & roads, Building blocks, Books
13. Female	6;0	K EEU	98	103[1]	36	Musical instruments, Dress-up, Cutting & gluing
14. Male	5;11	K EEU	100	99[1]	34	Water table, Uno, Legos, Puzzles

Note: Participant numbers reflect original participant numbers from Table 2.2

[1] Matrices subtest standard score from the Kaufman – Brief Intelligence Test (Kaufman & Kaufman, 1990); mean=100; SD=10

Table 2.9: Inclusion assessment and descriptive information for ASD-LOW subgroup (N = 8)

	Age (in years; months)	**Grade and School Site**	**CELF-Pre** (total language score: mean=100; SD=15)	**Nonverbal Measure**	**CARS** (rating score)	**Play Interest Survey** (examples of highly-motivating objects / activities)
1. Male	5;11	K EEU	111	106[2]	30	Books, Musical instruments, Dramatic play
2. Male	6;0	K EEU	95	107[3]	29.5	Mr. Potato Head, Building blocks, Legos
3. Male	6;7	K EEU	98	115[2]	34	Vehicles & roads, Drawing materials, Puzzles
4. Male	6;4	K EEU	102	109[2]	34	Legos, Lincoln Logs, Dramatic play
5. Male	5;7	K EEU	107	98[1]	32.5	Puzzles, Water table, Art

[2] Matrices subtest standard score from the Kaufman – Brief Intelligence Test (Kaufman & Kaufman, 1990); mean=100; SD=10
[3] Quotient score from the Test of Nonverbal Intelligence – Third Edition (Brown, Sherbenou & Johnsen, 1997); mean=100; SD=10

Table 2.9 (continued)

9. Male	6;8	K EEU	83	92[1]	34.5	Drawing materials, Puppets, Board games
10. Male	6;3	K EEU	81	85[1]	35	Tool bench & tools, Marble run, Dress-up
11. Female	5;6	K EEU	122	112[1]	32.5	Music instruments, Drawing materials, Kitchen toys

Note: Participant numbers reflect original participant numbers from Table 2.2

To ensure that no further differences separated the ASD subgroups from each other, independent two-sample *t* tests were completed to compare language, nonverbal performance and CARS ratings. Results revealed no statistically significant differences between the ASD-HI subgroup (*M* = 105.00, *SD* = 8.41) and the ASD-LOW subgroup (*M* = 97.62, *SD* = 16.02) for CELF-Pre Total Language Scores, *t* (12) = 1.02, p = .33; no statistically significant differences between ASD-HI (*M* = 107.67, *SD* = 5.92) and ASD-LOW (*M* = 101.25, *SD* = 10.79) for the nonverbal performance scores, *t* (11.99) = 1.42, p =.18 on either the TONI-3 or the K-BIT; and, no statistically significant differences between ASD-HI (*M* = 32.92, *SD* = 3.35) and ASD-LOW (*M* = 32.75, *SD* = 2.05) for the CARS rating scores, *t* (12) = .12, p =.91.

To ensure that both subgroups still demonstrated similar language and nonverbal skills as compared to the TDP group, independent two-sample *t* tests were completed comparing the ASD subgroups with the TDP group. Results revealed no statistically significant differences between the ASD-HI subgroup and the TDP group (*M* = 104.5; *SD* = 8.77) for CELF-Pre Total Language Scores *t* (16) = -.47, p =.65; and no statistically significant differences between ASD-HI subgroup and the TDP group (*M* = 99.58, *SD* = 7.08) for nonverbal performance scores *t* (16) = 1.526, p =.15 on either the TONI-3 or the K-BIT.

Independent two-sample *t* tests revealed no statistically significant differences between the ASD-LOW subgroup and the TDP group for CELF-Pre

Total Language Scores *t* (18) = -.92, p=.37; and no statistically significant differences between ASD-LOW subgroup and the TDP group for nonverbal performance scores *t* (18) = .89, p=.39 on either the TONI-3 or the K-BIT.

Having established the groups and subgroups that were used in data analysis, the study's specific research questions are presented:

Question 1: Do more able children with ASD differ from TDP during SA1 with regard to production of RI, as measured by RI production-opportunity ratio and RI rate? Question 1 allows for the examination of each group's production of RI during SA1 (between groups), as well as examination of the range of performance by both groups. Given the conflicting accounts of RI production by more able children with ASD in the literature, this baseline comparison of performance between groups will not only clarify the production of RI by more able children with ASD, but will also provide a benchmark of performance by typical peers by which to compare children with social communicative deficits.

The data analysis procedures for question 1 are presented here. The RI production-opportunity ratios for each participant for SA1 were calculated. Recall that the RI production-opportunity ratio is calculated by dividing the number of RI productions by the RI opportunities for each session. To determine each group's mean RI production-opportunity ratio for SA1, the RI production-opportunity ratios from all participants in the group were summed and divided by the number of participants in the group. The mean RI production-opportunity ratio from SA1 was then compared between groups; that is, the ASD group's mean RI production-opportunity ratio for SA1 was compared with the TDP group's mean RI production-opportunity ratio for SA1. Independent *t* test comparisons were used to detect statistically significant differences between groups.

The rate of RI productions was also analyzed to address this question. The number of RI productions by each participant for SA1 was divided by the number of minutes in the session to determine the RI rate for each participant. To determine each group's mean RI rate for SA1, the RI rates from all participants in the group were combined and divided by the number of participants in the group. The group's mean RI rate for SA1 was then compared between groups using the same comparison and statistical analysis described above.

Question 2: Does production of RI, as measured by RI production-opportunity ratio, during each session of the SA condition (SA1, SA2, SA3) differ from production of RI during the DA condition (DA1 and DA2 combined) within ASD subgroups and within the TDP group? Question 2 allows for examination of within ASD subgroup and within TDP group comparisons of RI productions during the SA condition versus the DA condition. This information will guide discussion regarding the utility of using one assessment methodology versus another for evaluation of RI productions.

The data analysis procedures for question 2 are presented here. To determine each ASD subgroup's mean RI production-opportunity ratio for each session, the RI production-opportunity ratios from all participants in the subgroup were summed and divided by the number of participants in the subgroup. To determine the TDP group's mean RI production-opportunity ratio, the method described in Question 1 was utilized. Each subgroup's mean RI production-opportunity ratio from each SA session was then compared with each subgroup's mean RI production-opportunity ratio from both DA sessions combined. The same within group comparisons were made for the TDP group.

For the ASD-HI subgroup, the Bonferroni[1] adjusted critical value ($\pm\ {}_{1-.05/6}t_{5} = \pm 4.197$) was compared to the standard *t* value to detect a statistically significant difference between the RI production-opportunity ratio from DA1 compared to that of DA2. No statistically significant difference in mean RI production-opportunity ratios was found between DA1 (*M* = 60.71, *SD* = 22.85) and DA2 (*M* = 81.02, *SD* = 13.46), $t(5) = -3.074$, $p = .03$ for the ASD-HI subgroup. Using the Bonferroni adjusted critical value of $\pm\ {}_{1-.05/6}t_{7} = \pm 3.620$ no statistically significant difference between DA1 (*M* = 73.89, *SD* = 17.73) and DA2 (*M* = 67.84, *SD* = 13.58) was found for the ASD-LOW subgroup, $t(7) = .62$, $p = .56$ for the ASD-LOW subgroup. And using a Bonferroni adjusted critical value of $\pm\ {}_{1-.05/6}t_{9} = \pm 2.923$, no statistically significant difference and between DA1 (*M* = 66.25, *SD* = 19.09) and DA2 (*M* = 72.30, *SD* = 12.28) was found for the TDP group, $t(9) = -1.14$, $p = .29$ for the TDP

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[1] Given the number of pairwise contrasts included many of the analyses, Bonferroni adjusted *t* tests were used to avoid the increased likelihood of Type I errors associated with multiple comparisons (Lomax, 2001).

group. Therefore, DA sessions were combined when compared to performance from each SA session.

Bonferroni adjusted paired *t* tests were then used to detect statistically significant differences within ASD subgroups and within the TDP group across sessions. That is, for each ASD subgroup (ASD-HI and ASD-LOW), Bonferroni adjusted paired *t* tests were completed to compare the within subgroup mean RI production-opportunity ratios between the following sessions: SA1 and combined DA sessions; SA2 and combined DA sessions; SA3 and combined DA sessions. The same within group comparison was made for the TDP group.

Question 3a: Does the contextual manipulation of making available highly-preferred objects/activities influence production of RI, as measured by RI production-opportunity ratio, for both groups (within ASD subgroups, within the TDP group, between the ASD subgroups and the TDP group, and between the ASD subgroups)? Question 3a allows for examination of the role of object/activity availability on production of RI. Previous research indicates that inclusion of highly-preferred objects/activities may increase the interactions of more able children with ASD; therefore examination of this contextual manipulation is warranted.

The data analysis procedures for question 3a are presented here. Again, the subgroup or group mean RI production-opportunity ratio (described above) was used to respond to this question. For both ASD subgroups, Bonferroni adjusted paired *t* tests were used to detect statistically significant differences between the following within subgroup comparison: the subgroup mean RI production-opportunity ratio for SA1 compared to that of SA2 to determine if changing the environment with regard to activities and toys influenced performance. The same within group comparison was made for the TDP group.

Independent *t* tests were used to detect statistically significant differences for the following between group comparisons: the ASD-HI subgroup's mean RI production-opportunity ratio for SA1 compared to the TDP group's mean RI production-opportunity ratio for SA1; and the ASD-HI subgroup's mean RI production-opportunity ratio for SA2 compared to that of the TDP group. The same comparisons were made between the ASD-LOW subgroup and the TDP group, as well as between the two ASD subgroups.

Question 3b: Does the contextual manipulation of changing physical settings (the classroom vs. the treatment room) influence production of RI, as measured by RI production-opportunity ratio, for both groups (within ASD subgroups, with the TDP group, between ASD subgroups and the TDP group, and between ASD subgroups)? Question 3b allows for examination of the role of physical setting on the production of RI. Previous research indicates that more able children with ASD demonstrate improved performance within particular physical settings; therefore, examination of this contextual manipulation is warranted.

The data analysis procedures for question 3b are presented here. Each (sub)group's mean RI production-opportunity ratio was used to respond to the question. For both ASD subgroups, Bonferroni adjusted paired *t* tests were used to detect statistically significant differences between the following within subgroup comparison: the mean RI production-opportunity ratio for DA1 compared to that of DA2 to determine if changing the environment with regard to physical setting influenced performance. The same within group comparison was made for the TDP group.

Bonferroni adjusted independent *t* tests were used to detect statistically significant differences for the following between group comparisons: ASD-HI subgroup's mean RI production-opportunity ratio for DA1 compared to that of the TDP group; and, ASD-HI subgroup's mean RI production-opportunity ratio for DA2 compared to that of the TDP group. The same comparisons were made between the ASD-LOW subgroup and the TDP group, as well as between the two ASD subgroups.

Question 4a: Do ASD subgroups differ from the TDP group across DA sessions with regard to average cueing level necessary to facilitate production of RI, as measured by the session production cueing ratio? Question 4a allows for comparison of the average cueing level necessary to facilitate RI productions. That is, this question investigates whether more able children with ASD (both high RI performers and low RI performers) require a higher average cueing level to produce a RI than TDP? This question will also provide information regarding the level of cue (e.g., spontaneous, model, indirect cue, direct cue) that most often facilitates production of RI, thus possibly informing intervention.

The data analysis procedures for question 4a are presented here. Each (sub)group's mean session production cueing ratio was used to respond to this question. Please recall that each *participant's* session production cueing ratio was calculated by dividing his/her total session cued score by the total number of RI productions during the session. To determine each (sub)group's mean session production cueing ratio, the session production cueing ratio from all participants in the (sub)group were summed and divided by the number of participants in the (sub)group.

The mean session production cueing ratio was then compared between groups: the mean session production cueing ratio of the ASD-HI subgroup for DA1 was compared with the mean session production cueing ratio of the TDP group for DA1; and the mean session production cueing ratio of the ASD-HI subgroup for DA2 was compared with the mean session production cueing ratio of the TDP group for DA2. The same comparisons were made between the ASD-LOW subgroup and the TDP group. Independent *t* tests were used to detect statistically significant differences between (sub)groups.

Question 4b: During DA, how responsive are the ASD subgroups to cues at each cueing level, as measured by the subgroup's mean cues provided at each cueing level and the subgroup's mean RI productions at each cueing level? Question 4b allows for examination of both ASD subgroup's responsiveness to each of the four different levels of linguistic cueing. That is, comparison of the number of cues provided at each cueing level with the number of RI productions at each cueing level will provide information about whether ASD subgroups take advantage of cueing *at each* cue level. This differs from the previous question by allowing for finer examination of responsiveness to cues at each cueing level, rather than the broad examination of responsiveness provided by the average cueing level from question 4a. Only the ASD subgroup are examined in this question (and question 4c), because these questions may inform future intervention with regard to number and type of cues provided to facilitate production of RI within this population.

The data analysis procedures for question 4b are presented here. Individual frequency of occurrence counts of the total number of cues provided at each cueing level were summed and then divided by the total number of participants in the subgroup, resulting in the subgroup's mean RI productions at each cueing level. Individual frequency of occurrence counts of RI productions at each cueing level were summed and then divided by the total number of participants in each subgroup, resulting in the subgroup's mean cues per level. Paired *t* tests were used to detect statistically significant differences between the following within ASD subgroup comparisons for performance during DA1: the mean RI productions at cueing level 1 compared with the mean number of cues provided at cueing level 1; the mean RI productions at cueing level 2 compared with the mean number of cues provided at cueing level 2; the mean RI productions at cueing level 3 was compared to the mean number of cues provided at cueing level 3; the mean RI productions at cueing level 4 was compared to the mean number of cues provided at cueing level 4. The same comparisons were also made for performance during DA2.

Question 4c: For ASD subgroups, during DA, which cueing level appears to be most effective and which cueing level appears to be least effective in facilitating production of RI, as measured by the percentage of cues that resulted in a RI production at each cueing level? Questions 4c allows for within ASD subgroup comparison of percentage of cues that resulted in a RI production across each cueing level. As indicated above, determining which cueing level is the most and least effective for more able children with ASD may inform intervention techniques with regard to the number and type of cueing provided to facilitate production of RI.

The data analysis procedures for 4c are presented here. Recall that each participant's percentage of cues resulting in a RI production was calculated by dividing his/her frequency of occurrence count of RI productions at each cueing level by his/her frequency of occurrence count of cues provided at each cueing level, then multiplying by 100. To determine the subgroup's mean percentage of cues resulting in a RI production, each participant's individual percentage of cues resulting in a RI production were summed and divided by the number of participants in the subgroup. Bonferroni adjusted paired *t* tests were used to detect statistically significant differences in the percentage of cues that resulted in a RI production at each cueing level of DA1 for the following within ASD subgroup comparisons: cueing level 1 compared to cueing level 2; cueing level 1 compared to cueing level 3; cueing level 1 compared to cueing level 4; cueing level 2 compared to cueing level 3; cueing level 2 compared to cueing level 4; cueing level 3 compared to cueing level 4. The same comparisons were also made for DA2.

Question 5a: Do children within each ASD subgroup and within the TDP group demonstrate a change in production of RI, as measured by RI production-opportunity ratio, across SA sessions? Question 5a allows for within (sub)group examination of participants' production of RI across SA sessions. Previous application of dynamic assessment methodology has resulted in increased performance of the target behavior following DA intervention. As such, comparison of within (sub)group performance prior to the DA condition (SA1, SA2) and following the DA condition (SA3) will provide information regarding the function of DA for RI production for each (sub)group (i.e., was DA teaching participants a new skill or providing an environment that facilitated demonstration of a previously acquired skill?).

The data analysis procedures for question 5a are presented here. Mean performance on the RI production-opportunity ratio for each subgroup or group (as indicated) was calculated for each SA session. Bonferonni adjusted paired *t* tests were used to detect statistically significant differences in performance within ASD subgroups across the following sessions: the RI production-opportunity ratio for SA1 was compared with SA2; the RI production-opportunity ratio for SA2 was compared with SA3; and, the RI production-opportunity ratio for SA1 was compared with SA3. The same within group comparisons were made for the TDP group.

Question 5b: Do children within each ASD subgroup and within the TDP group demonstrate a change in unelicited performance, as measured by the free-play RI rate, across SA sessions? Question 5b allows for a more detailed examination of RI productions across SA sessions. By comparing one component of each SA session, the 'free-play' portion of the session, one is able to investigate whether unelicited RI performance changed.

The data analysis procedures for question 5b are presented here. The free play RI rate (the number of RI produced during the first five minutes of free play divided by 5 minutes) was used to determine if the participant's unelicited production of RI changed across the course of the study for each subgroup or group (as indicated) of children. To determine each (sub)group's mean free play RI rate for each session, the free play RI rates from all participants in the (sub)group were summed and divided by the number of participants in the (sub)group. Bonferroni adjusted paired *t* tests were used to detect statistically significant differences within ASD subgroups across the following sessions: the mean free play RI rate for SA1 was compared with SA2; the mean free play RI rate for SA2 was compared with SA3; and, the mean free play RI rate for SA1 was compared with SA3. The same within group comparisons were made for the TDP group.

CHAPTER III: RESULTS

Results are presented to address the study's five areas of inquiry: 1) children's overall production of RI (between groups); 2) children's production of RI during SA condition versus DA condition to examine the influence of cueing on productions (within groups); 3) the influence of contextual manipulations on production of RI (within and between groups); 4) the influence of linguistic manipulations on production of RI (within and between groups); and, 5) possible change in production of RI across SA sessions to examine possible change in performance over time (within groups).

Each section addresses the specific research questions associated with the area of inquiry. As reported in Chapter 2, the following RI measures were used in the data analysis: RI production-opportunity ratio; RI rate; free-play RI rate; session production cueing ratio; mean cues provided per cueing level; mean RI productions at each cueing level; and, percentage of cues resulting in RI production. Table 3.1 provides a brief review of how the RI measures were calculated.

Table 3.1: RI measures and calculations

RI Measure	Calculation Description
RI production-opportunity ratio	Total # of RI productions during session / Total # of RI opportunities during session
RI rate	Total # of RI productions / Total length of session in minutes
Free-play RI ratio	Total # of RI productions during free-play portion of session / Total # of RI productions during session
Session production cueing ratio	Total session cued score (total # of cues provided during a session) / Total #of RI productions during session
Cues per cueing level	Frequency of occurrence count of number of cues provided at each cueing level
RI productions per cueing level	Frequency of occurrence count of RI productions at each cueing level
Percentage of cues resulting in RI production	(Frequency of occurrence count of RI productions at each cueing level / frequency of occurrence count of number of cues provided at each cueing level) multiplied by 100

For the analyses that involved multiple pairwise contrasts, standard *t* test statistics were adjusted using the Bonferroni method in an effort to avoid the increased likelihood of Type I errors associated with multiple comparisons (Lomax, 2001); an alpha level of .05 was used to determine the Bonferri critical value with which to compare the standard *t* test value. The Bonferroni method allowed for comparisons of multiple planned comparisons **within** ASD subgroups and within the TDP group. Analyses involving comparison of contrasts **between** the ASD subgroups and the TDP group were mutually exclusive, that is there were no overlapping contrasts, and therefore did not require a Bonferri *t* statistic adjustment. As such, independent *t* tests were used for these analyses; an alpha level of .05 was used to determine the statistical significance of performance differences.

Children's Overall Production of RI

This section presents a comparison of each group's production of RI across all sessions as measured by each group's mean RI production-opportunity ratio and their mean RI rate.

Question 1: Do more able children with ASD differ from TDP during SA1 with regard to production of RI, as measured by RI production-opportunity ratio and RI rate?

The RI production-opportunity ratio was used to address this question (see Table 3.1). Recall, each participant's RI production-opportunity ratio represents the percentage of opportunities that resulted in production of RI for each session.

To determine each group's mean RI production-opportunity ratio for SA1, the RI production-opportunity ratios from all participants in the group were summed and divided by the number of participants in the group. The mean RI production-opportunity ratio from SA1 was then compared between groups. Table 3.2 displays each group's mean RI production-opportunity ratio, standard deviation, and RI production-opportunity ratio range for SA1. Table 3.2 also displays the production-opportunity ratios for each group for all other sessions (SA2, DA1, DA2, SA3) to orient the reader to the overall performance of each group; these data will be discussed in detail for questions two through five below.

An independent *t* test indicated that during SA1 the ASD group (M = 42.21, SD = 20.62) produced fewer RI than the TDP group (M = 67.14, SD = 17.38), $t(22)$ = -3.11, p = .005 (two-tailed). Thus, during SA1, the ASD group produced fewer RI than the TDP group.

In order to further investigate this RI production-opportunity ratio difference between the ASD and TDP groups during SA1, the ASD subgroups (HI and LOW) were compared with the TDP group. An independent *t* test revealed no statistically significant differences between the ASD-HI subgroup's mean RI production-opportunity ratio (M = 51.89, SD = 15.46) and the TDP group's mean RI production-opportunity ratio for SA1, $t(14)$ = -1.77, p = .10. However, an independent *t* test indicated that during SA1 the ASD-LOW subgroup (M = 34.94, SD = 21.87) produced significantly fewer RI than the TDP group, $t(16)$ = -3.49, p =

.003 (two-tailed).   Thus, the ASD-HI group performed similarly to the TDP group with regard to RI productions during SA1, while the ASD-LOW group demonstrated significantly fewer RI productions than the TDP group. This suggests that the overall ASD group performance described above was influenced by the ASD-LOW performance, which "drove" down the overall performance when compared to the TDP group.

Table 3.2: Group means and standard deviations for RI production-opportunity ratios across all sessions

Assessment Session	Mean RI production-opportunity ratios		Standard deviation		Range	
	ASD group N = 14	TDP group N = 10	ASD	TDP	ASD	TDP
SA1	42.21_a	67.14_b	20.62	17.38	7.69 to 72.73	41.67 to 92.31
SA2	55.80_a	66.39_a	22.96	23.79	10.00 to 90.91	25.00 to 100.00
DA1	68.24_a	66.25_a	20.39	19.09	23.08 to 100.00	25.00 to 90.00
DA2	73.49_a	72.30_a	14.66	12.28	46.67 to 100.00	50.00 to 94.12
SA3	51.65_a	63.82_a	25.15	17.10	14.29 to 92.31	38.46 to 90.00

Note. Means with different subscripts differ significantly at $p < .05$ in independent t test comparisons.

The rate of RI productions was also analyzed to address this question. Recall RI rate represents the number of RI produced per minute by each participant (see Table 3.1). To determine each group's mean RI rate, the RI rates from all participants in the group were combined and divided by the number of participants in the group. The group's mean RI rate for SA1 was then compared between groups using the same comparisons and statistical analysis described above. Table 3.3 displays each group's mean RI rates and standard deviations during SA1. Again, to orient the reader to each group's overall performance, Table 3.3 provides RI rate data for all other assessment sessions as well as SA1..

An independent *t* test indicated that during SA1 the ASD group (M = .35, SD = .23) produced fewer RI per minute as compared with TDP (M = .61, SD = .27), $t(22) = -2.61$, $p = .02$ (two-tailed). Consistent with the previous analysis, the ASD group demonstrated a significantly lower rate of RI production than the TDP group during SA1.

In order to further investigate the RI rate difference between the ASD and TDP groups during SA1, the ASD subgroups (HI and LOW) were compared with the TDP group. An independent *t* test revealed no statistically significant differences between the ASD-HI subgroup's mean RI rate (M = .49, SD = .20) and the TDP group's mean RI rate for SA1, $t(14) = -.95$, $p = .36$. However, an independent *t* test indicated that during SA1 the ASD-LOW subgroup (M = .24, SD = .20) produced significantly fewer RI per minute than the TDP group, $t(16)$ = -

3.32, $p = .004$ (two-tailed). Again, this suggests that the overall ASD group performance described above was influenced by the ASD-LOW performance.

Table 3.3: Group means and standard deviations for RI rate across all sessions

Assessment Session	Mean RI rate		Standard deviation	
	ASD group N = 14	TDP group N = 12	ASD	TDP
SA1	$.35_a$	$.61_b$	.23	.27
SA2	$.54_a$	$.57_a$	.26	.35
DA1	$.61_a$	$.77_a$	.24	.31
DA2	$.78_a$	$.87_a$	.27	.34
SA3	$.41_a$	$.50_a$	.28	.22

Note. Means with different subscripts differ significantly at $p < .05$ in independent t test comparisons.

The range of RI productions for both groups, as measured by the RI production-opportunity ratio, were also identified. As Table 3.2 displays, both the TDP group and the ASD group demonstrated a wide range of RI productions during SA1.

Visual inspection of the statistics reveals a wide range of performance by both the ASD and TDP groups, as measured by the RI production-opportunity ratio across SA1. These data suggest that production of RI varies not only amongst more able children with ASD, but also amongst typically-developing children. Looking across all assessment sessions, the participants in the TDP appeared to consistently take advantage of at least 25% of the RI opportunities provided, whereas at least one participant in the ASD group fell well below this level of performance during SA1 (producing RI for only 7% of the opportunities provided). This may suggest that while production of RI is a variable behavior across groups, the TDP group more consistently utilizes opportunities to produce RI.

Production of RI during the SA condition versus the DA condition

This section presents a within ASD subgroup and within TDP group comparison of RI production during each SA session and production of RI during both DA sessions combined, allowing investigation of the two assessment methods (SA and DA) for examining production of RI in young children.

Question 2: Does production of RI, as measured by RI production-opportunity ratio, during each session of the SA condition (SA1, SA2, SA3)

differ from production of RI during the DA condition (DA1 and DA2 combined) within ASD subgroups and within the TDP group?

Using the same method described above, each (sub)group's mean RI production-opportunity ratio from each SA session was then compared with each (sub)group's mean RI production-opportunity ratio from both DA sessions combined. Recall that paired *t* test comparisons within each (sub)group revealed no statistically significant differences between the (sub)group's mean RI production-opportunity ratio for DA1 and DA2. Therefore, DA sessions for each (sub)group were combined when compared to performance from each SA session. The following within ASD subgroup analyses were completed: the mean RI production-opportunity ratio for SA1 was compared with the mean combined RI production-opportunity ratio for DA; the mean RI production-opportunity ratio for SA2 was compared with the mean combined RI production-opportunity ratio for DA; and, the mean RI production-opportunity ratio mean for SA3 was compared with the mean combined RI production-opportunity ratio for DA. The same analyses were completed within the TDP group.

For the ASD-HI subgroup, Bonferroni adjusted paired *t* tests (using the critical value of $\pm\ _{1\text{-}.05/3}t_{5} = \pm 3.518$) revealed no statistically significant differences between the mean RI production-opportunity ratio for SA1 (M = 51.89, SD = 15.46) as compared to the combined DA sessions (M = 70.86, SD = 16.92), $t(5) = -1.945$, p =.109; for SA2 (M =56.08, SD = 24.25) as compared to the combined DA session, *t*(5) = -1.249, *p* =.267; and for SA3 (*M* = 61.02, *SD* = 22.61) as compared to the combined DA session, *t*(5) = -1.370, *p* =.229.

Figure 3.1 displays the ASD-HI subgroup's mean RI production-opportunity ratio RI production-opportunity ratio for SA1, SA2, combined DA, and SA3 sessions.

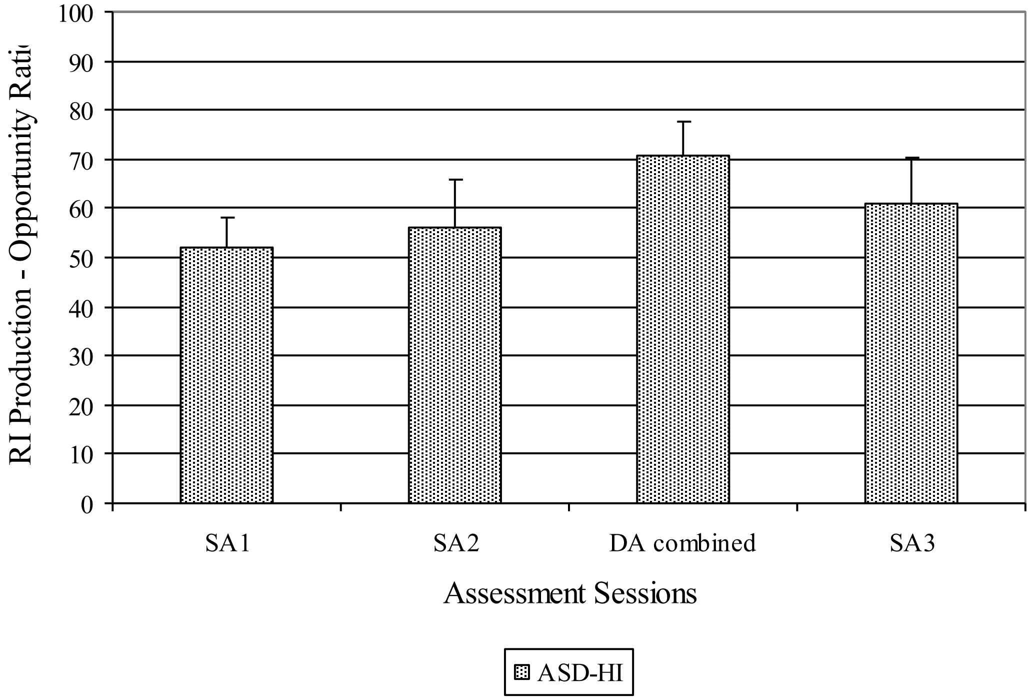

Figure 3.1: ASD-HI subgroup's mean RI production-opportunity ratio across SA1, SA2, combined DA (DA1 and DA2), and SA3 sessions

Using the Bonferonni critical value ($\pm\ _{1-.05/3}t_{7} = \pm 3.620$), a paired *t* test comparison revealed that the ASD-LOW subgroup produced significantly *fewer* RI during SA1 (*M* = 34.94, *SD* = 21.87) than during the combined DA sessions (*M* = 70.86, *SD* = 7.47), $t(7) = -3.886$, $p = .006$. However, no statistically significant differences were found between mean RI production-opportunity ratio for SA2 (*M* = 55.60, *SD* = 23.64) and the combined DA session, $t(7) = -2.099$, $p = .074$; as well as the SA3 session (*M* = 44.62, *SD* = 26.04) and the combined DA session, $t(7) = -2.645$, $p = .033$. Figure 3.2 displays the ASD-LOW subgroup's mean RI production-opportunity ratio for SA1, SA2, combined DA, and SA3 sessions.

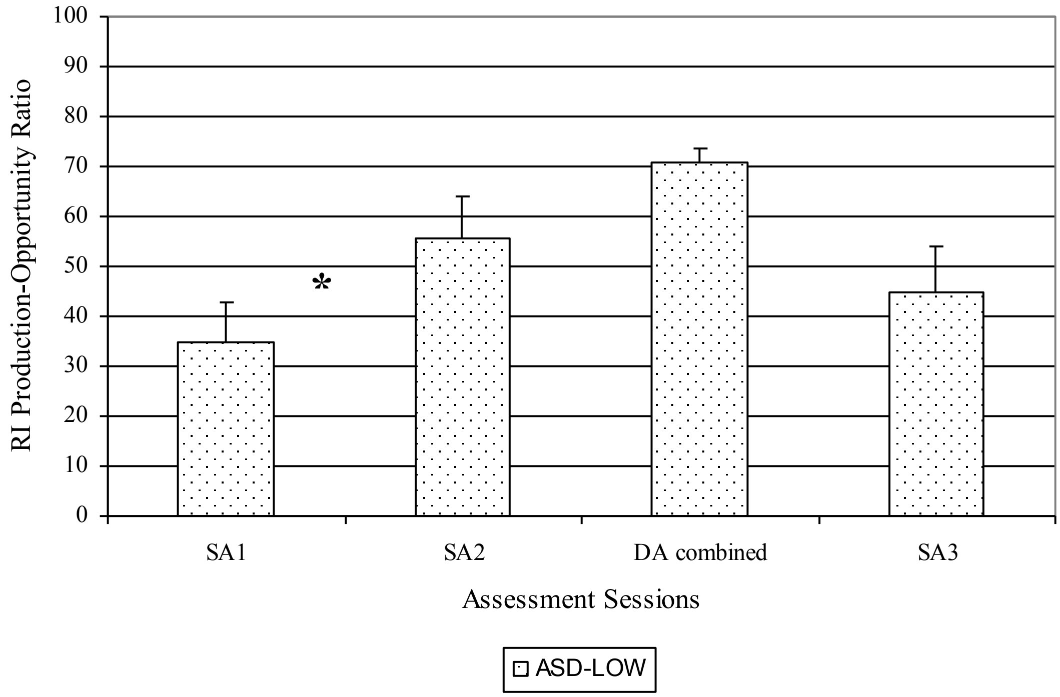

Figure 3.2: ASD-LOW subgroup's mean RI production-opportunity ratio across SA1, SA2, combined DA (DA1 and DA2), and SA3 sessions

*p <.05

The Bonferroni adjusted critical value (± $_{1-.05/3}t_{9}$ = ± 2.923) was compared to the standard paired *t* test values in order to detect significant differences in RI production-opportunity ratios for the aforementioned comparisons within the TDP group. Paired *t* test comparisons revealed no statistically significant differences between the TDP group's mean RI production-opportunity ratio for SA1 (*M* = 67.14, SD = 17.38) and the combined DA sessions (*M* = 69.28, *SD* = 13.66), *t*(10) = -.592, *p* = .569; between the mean RI production-opportunity ratio for SA2 (*M* = 66.39, *SD* = 23.79) and the combined DA sessions, *t*(10) = -.585, *p* = .573; and between the mean RI production-opportunity ratio for SA3 (*M* = 63.82, *SD* = 17.10), *t*(10) = -1.016, *p* =.336. In other words, TDP demonstrated similar performance when comparing all SA sessions with performance during the DA condition. Figure 3.3 displays the performance of the TDP group.

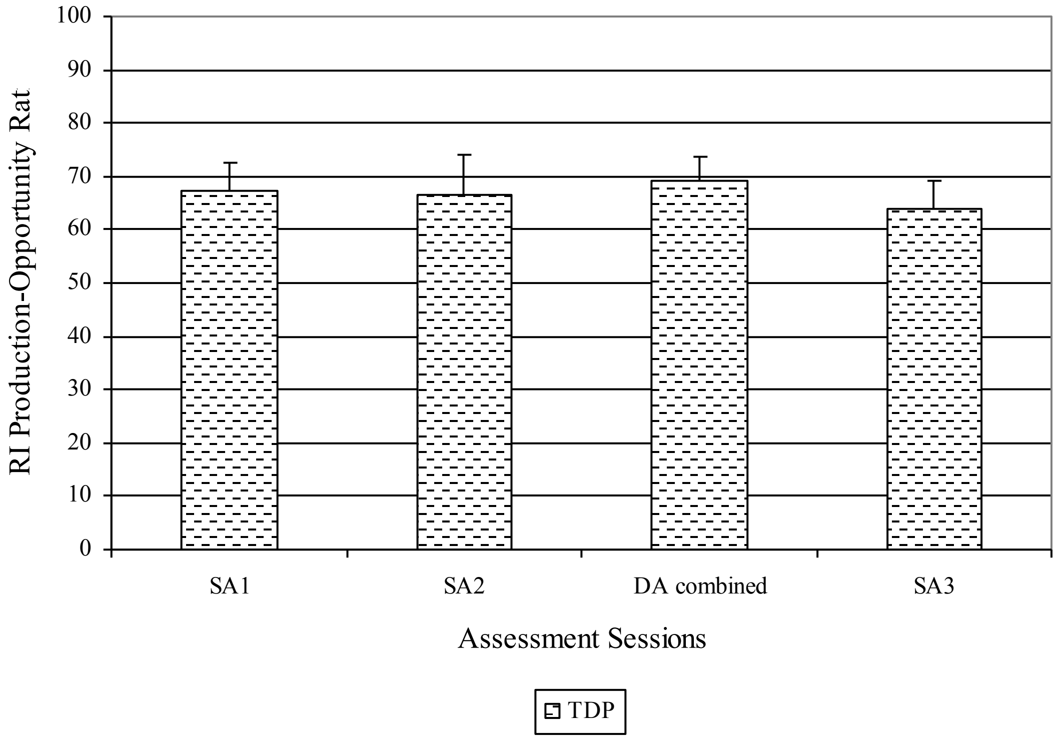

Figure 3.3: TDP group's mean RI production-opportunity ratio across SA1, SA2, combined DA (DA1 and DA2), and SA3 sessions

The Influence of Contextual Manipulations on Production of RI

This section presents within (sub)group and between group comparisons of production of RI across sessions in which contextual variables (object/activity choice, physical environment) were manipulated.

Question 3a: Does the contextual manipulation of making available highly-preferred objects/activities influence production of RI, as measured by RI production-opportunity ratio, for both groups (within ASD subgroups, within the TDP group, between the ASD subgroups and the TDP group, and between the ASD subgroups)?

Each (sub)group's mean RI production-opportunity ratio was again used to respond to this question. Each (sub)group's mean RI production-opportunity ratio for SA1 was compared to that of SA2 to determine if changing the context variable of object/activity choice influenced production of RI. To first compare performance within the ASD-HI subgroup, the Bonferroni adjusted critical value ($\pm$ $_{1\text{-}.05/3}t_{5}$ = $\pm$ 3.518) was compared to the standard paired *t* test value in order to detect significant differences in RI production-opportunity ratios between SA1 and SA2 sessions. A paired *t* test comparison revealed no statistically significant differences between the mean RI production-opportunity ratio for SA1 (51.87, *SD* =15.46) and SA2 (*M* = 56.08, *SD* = 24.25), $t(5) = -536$, $p = .615$. These results suggest that the availability of highly-preferred objects/activities did not significantly increase the ASD-HI subgroup's production of RI during SA2.

For the ASD-LOW subgroup, the Bonferroni adjusted critical value ($\pm\ _{1-.05/3}t_{7} = \pm$ 3.115) was compared to the standard paired *t* test value in order to detect significant differences in RI production-opportunity ratios between SA1 and SA2. A paired *t* test comparison revealed no statistically significant differences between the mean RI production-opportunity ratio for SA1 (M = 34.94, SD = 21.87) and SA2 (M = 55.60, SD = 23.64), $t(7) = -1.844$, $p = .108$. Thus, similar to the ASD-HI subgroup, the ASD-LOW subgroup's production of RI did not significantly increase with the availability of highly-preferred objects/activities.

For the TDP group, the Bonferroni adjusted critical value ($\pm\ _{1-.05/3}t_{9} = \pm$ 2.923) was compared to the standard paired *t* test value in order to detect significant differences in RI production-opportunity ratios between SA1 and SA2. A paired *t* test comparison revealed no statistically significant differences between the mean RI production-opportunity ratio for SA1 (M = 67.14, SD = 17.38) and SA2 (M = 66.39, SD = 23.79), $t(9) = .111$, $p = .914$. The TDP group's performance was similar across SA1 and SA2.

Independent *t* tests were used to detect statistically significant differences for the following between (sub)group comparisons: ASD-HI subgroup's mean RI production-opportunity ratio for SA1 compared to TDP group's mean RI production-opportunity ratio for SA1; and, ASD-HI subgroup's mean RI production-opportunity ratio for SA2 compared to TDP group's mean RI production-opportunity ratio for SA2. The same comparisons were made between the ASD-LOW subgroup and the TDP group, as well as between the ASD subgroups.

As reported in question 1, no statistically significant differences were found between the mean RI production-opportunity ratio during SA1 for the ASD-HI subgroup (M = 51.88, SD = 15.46) compared to the TDP group (M = 67.14, SD = 17.38), $t(14) = -1.77$, $p = .09$ (two-tailed). For the SA2 comparison, no statistically significant differences were found between the ASD-HI subgroup's mean RI production-opportunity ratio (M = 56.08, SD = 15.46) and the TDP group's mean production-opportunity ratio (M = 66.39, SD = 23.79), $t(14) = -.83$, $p = .42$. Thus, the ASD-HI subgroup and the TDP group performed similarly across both SA1 and SA2 sessions.

For SA1, an independent t test revealed that the ASD-LOW subgroup (M = 34.94, SD = 21.87) produced significantly fewer RI than the TDP group, $t(16) = -3.49$, $p = .003$ (two-tailed). For the SA2 comparison, no statistically significant differences were found between the ASD-LOW subgroup's mean RI production-opportunity ratio (M = 55.60, SD = 23.64) and the TDP group's mean opportunity ratio, $t(16) = -.96$, $p = .35$. Compared to the TDP group, children with ASD-LOW subgroup demonstrated significantly fewer RI productions during SA1 when typical objects/activities were available. However, between group performance was similar during SA2 when highly-preferred objects/activities were available. In other words, for the ASD-LOW subgroup, production of RI increased to TDP levels when highly-preferred objects/activities were made available (SA2).

Finally, between ASD subgroup comparison of mean RI production-opportunity ratios during SA1, revealed no statistically significant differences, $t(12) = 1.61$, $p = 13.$ (two-tailed). For the SA2 comparison, no statistically significant differences were found between the ASD-HI subgroup's mean RI production-opportunity ratio and the ASD-LOW subgroup's mean opportunity ratio, $t(12) = .04$, $p = .97$. Both ASD subgroups performed similarly across SA1 and SA2.

Question 3b: Does the contextual manipulation of changing physical environments (the classroom vs. the treatment room) influence production of RI, as measured by RI production-opportunity ratio, for both groups (within ASD subgroups, with the TDP group, between ASD subgroups and the TDP group, and between ASD subgroups)?

Again, each (sub)group's mean RI production-opportunity ratio was used to respond to the question. The (sub)group's mean RI production-opportunity ratio for DA1 was compared to that of DA2 to determine if changing the context variable of object/activity choice influenced production of RI. For the ASD-HI subgroup, the Bonferroni adjusted critical value ($\pm\ _{1-.05/6}t_{5\ =}\ \pm$ 4.197) was compared to the standard *t* value to detect a statistically significant difference between the RI production-opportunity ratio from DA1 compared to that of DA2. No statistically significant difference in mean RI production-opportunity ratios was found between

DA1 (M = 60.71, SD = 22.85) and DA2 (M = 81.02, SD = 13.46), $t(5) = -3.074$, p = .03 for the ASD-HI subgroup. For the ASD-LOW subgroup, using the Bonferroni adjusted critical value of $\pm\ {}_{1-.05/6}t_{7} = \pm\ 3.620$ no statistically significant difference between DA1 (M = 73.89, SD = 17.73) and DA2 (M = 67.84, SD = 13.58) was found, $t(7) = .62$, $p = .56$ for the ASD-LOW subgroup. Thus, children with ASD, in both subgroups, demonstrated similar within subgroup performance across both physical environments (classroom and treatment room).

For the TDP group, using a Bonferroni adjusted critical value of $\pm\ {}_{1-.05/6}t_{9} = \pm$ 2.923, no statistically significant difference and between DA1 (M = 66.25, SD = 19.09) and DA2 (M = 72.30, SD = 12.28) was found for the TDP group, $t(9) = -1.14$, $p = .29$. The TDP group demonstrated similar within group performance across both physical environments (classroom and treatment room).

Independent t tests were used to detect statistically significant differences for the following between (sub)group comparisons: ASD-HI subgroup's mean RI ratio for DA1 compared to TDP group's mean RI production-opportunity ratio for DA1 and ASD-HI subgroup's mean RI ratio for DA2 compared to TDP group's mean RI ratio for DA2. The same between group comparisons were made for ASD-LOW subgroup and the TDP group, and between ASD subgroups.

For the DA1 comparison between the ASD-HI subgroup and the TDP group, no statistically significant differences were found between the ASD-HI subgroup's mean RI production-opportunity ratio (M = 60.71, SD = 22.85) and the

TDP group's mean RI production-opportunity ratio (*M* = 66.25, *SD* = 19.09), *t*(14) = -.52, *p* = .61 (two-tailed). For the DA2 comparison, no statistically significant difference was found between the ASD-HI subgroup's mean RI production-opportunity ratio (*M* = 81.02, *SD* = 13.46) and the TDP group's mean RI production-opportunity ratio (*M* = 72.30, *SD* = 12.28), *t*(14) = 1.33, *p* = .21. In other words, children in the ASD-HI subgroup performed similarly to the TDP group across both physical environments.

For the DA1 comparison between the ASD-LOW subgroup and the TDP group, and independent *t* test revealed no statistically significant differences between the ASD-LOW subgroup's mean RI production-opportunity ratio (*M* = 73.89, *SD* = 17.73) and the TDP group's mean RI production-opportunity ratio, *t*(16) = .87, *p* = .40 (two-tailed). For the DA2 comparison, no statistically significant difference was found between the ASD-LOW subgroup's mean RI production-opportunity ratio (*M* = 67.84, *SD* = 13.58) and the TDP group's mean RI production-opportunity ratio, *t*(16) = -.73, *p* = .48. Thus, children in the ASD-LOW subgroup also performed similarly to the TDP group across both physical environments.

Finally, an independent *t* test comparison between the ASD-HI subgroup and the ASD-LOW subgroup revealed no statistically significant differences between mean RI production-opportunity ratios for DA1, *t*(12) = -1.22, *p* = .25. And, no statistically significant difference was found between the ASD-HI and

ASD-LOW subgroups for DA2, $t(12) = 1.80$, $p = .10$. Children with ASD in both subgroups demonstrated similar performance across DA1 and DA2.

The Influence of Linguistic Manipulations on the Production of RI

This section presents within (sub)group and between group comparisons of production of RI across sessions in which linguistic variables were manipulated.

Question 4a: Do ASD subgroups differ from the TDP group across DA sessions with regard to average cueing level necessary to facilitate production of RI, as measured by the session production cueing ratio (between groups)?

Each (sub)group's mean session production cueing ratio was used to respond to this question. Recall that each participant's session production cueing ratio was calculated by dividing his/her total session cued score by the total number of RI productions during the session. Thus each participant's session production cueing ratio represents the average cueing level necessary to facilitate production of RI. Because the session production cueing ratio includes all cueing level values provided to the participant divided by the total number of *RI productions* for the session, it is possible for the session production cueing ratio to exceed the maximum cueing level (level 4: direct cue).

For example, if a participant achieved a total session cued score of 25 (indicating that he/she had been provided 25 levels of cueing over the course of the session), but only produced 5 RI, his/her session production cueing ratio would equal of 5. Thus, indicating that he/she received cueing for a number of opportunities that did not result in a production of RI. See Table 2.6 for a review of the session production ratio scoring method.

To determine each (sub)group's mean session production cueing ratio, the session production cueing ratios from all participants in the (sub)group were summed and divided by the number of participants in the (sub)group. Independent *t* tests were then used to detect statistically significant differences for the following between group comparisons: the ASD-HI subgroup's mean session production cueing ratio for DA1 compared to the TDP group's mean session production cueing ratio for DA1; and, the ASD-HI subgroup's mean session production cueing ratio for DA2 compared to the TDP group's mean session production cueing ratio for DA2. The same comparisons were made between the ASD-LOW subgroup and the TDP group, as well as between ASD subgroups.

For the DA1 comparison, results indicated no statistically significant difference between the ASD-HI subgroup's mean session production cueing ratio ($M = 4.80$, $SD = 3.71$) and the TDP group's mean session production cueing ratio ($M = 3.10$, $SD = 1.68$), $t(15) = 1.32$, $p = .21$ (two-tailed). For the DA2 comparison, no statistically significant difference was found between the ASD-HI subgroup's mean session production cueing ratio ($M = 2.43$, $SD = .65$) and the TDP group's mean session production cueing ratio ($M = 2.69$, $SD = .87$), $t(15) = -.64$, $p = .53$. In other words, the ASD-HI subgroup received a similar average cueing level per production of RI as the TDP group during both DA1 and DA2.

An independent *t* test comparison between the ASD-LOW subgroup's mean session production cueing ratio (*M* = 3.39, *SD* = 1.16) and the TDP group's mean session production cueing ratio for DA1 revealed no statistically significant differences, *t*(17) = .41, *p* = .69 (two-tailed). For the DA2 comparison, no statistically significant difference was found between the ASD-LOW subgroup's mean session production cueing ratio (*M* = 3.55, *SD* = .1.04) and the TDP group's mean session production cueing ratio, *t*(18) = 2.01, *p* = .06. Thus, the ASD-LOW subgroup also received a similar average cueing level per production of RI as the TDP group during both DA1 and DA2.

Finally, an independent *t* test comparison between the ASD-HI subgroup and the ASD-LOW subgroup revealed no statistically significant differences between mean RI production-opportunity ratios for DA1, *t*(12) = 1.03, *p* = .33. However, during DA2 the ASD-HI subgroup received a significantly lower average cueing level than the ASD-LOW subgroup, *t*(12) = -2.31, *p* = .04. Thus, children in the ASD-LOW subgroup required a higher average level of cueing to produce RI during DA2 than children in the ASD-HI subgroup. Figure 3.4 displays each group's mean session production cueing ratio across DA1 and DA2.

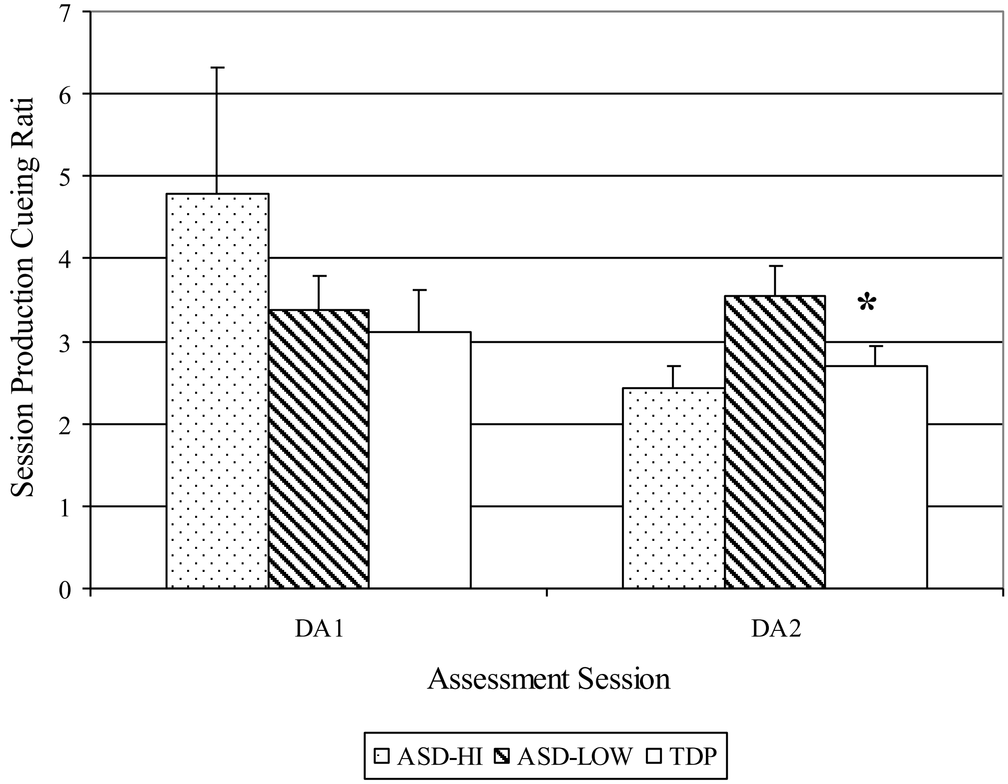

Figure 3.4: Each (sub)group's mean session production cueing ratio for DA1 and DA2

*p <.05

Question 4b: During DA, how responsive are the ASD subgroups to cues at each cueing level, as measured by the subgroup's mean cues provided at each cueing level and the subgroup's mean RI productions at each cueing level?

The subgroup's mean number of cues provided per cueing level and mean RI production at each cueing level were used to address this question (see Table 3.1 for a review of measure calculations). The following within ASD subgroup analyses for DA1 were made: the mean number of cues provided at cueing level 1 compared with the mean RI productions at cueing level 1; the mean number of cues provided at cueing level 2 compared with the mean RI productions at cueing level 2; the mean number of cues provided at cueing level 3 was compared to the mean RI productions at cueing level 3; the mean number of cues provided at cueing level 4 was compared to the mean RI productions at cueing level 4. The same comparisons were also made for performance during DA2.

For DA1, paired *t* tests indicated that children in the ASD-HI subgroup received significantly more cues at each cue level than resulted in RI productions at each level except cueing level 4. Table 3.4 displays the means and standard deviations for the number of cues provided at each cueing level and the RI productions at each cueing level for DA1 and DA2 for the ASD-HI subgroup. The paired *t* test results for each cueing level for DA1 are as follows (using a Bonferonni adjusted critical value of $\pm\ {}_{1-.05/4}t_{5} = \pm 3.791$): cueing level 1, $t(5) =$

6.140, p =.002; cueing level 2, $t(5) = 6.006$, p =.002; cueing level 3, $t(5) = 5.000$, p =.004; and, cueing level 4, $t(5) = 2.712$, p =.042. These results indicate that the children in the ASD-HI subgroup received significantly more cues than they responded to at each cueing level except for cueing level 4. Figure 3.5 displays the mean number of cues provided at each cueing level and the mean RI productions at each cueing level for DA1 for the ASD-HI subgroup.

Using the same Bonferroni adjusted critical value for DA2, paired *t* tests indicated that children in the ASD-HI subgroup received significantly more cues at cue levels 1 and 2 than resulted in RI productions. The paired *t* test results for each cueing level for DA2 are as follows: cueing level 1, $t(5) = 8.199$, p =.000; cueing level 2, $t(5) = 9.562$, p =.000; and cueing level 3, $t(5) = 2.500$, p =.054. A *t* test comparison of cueing level 4 could not be made as the mean number of cues and the mean RI productions at that cueing level were the same, thus the standard error of the difference was zero (see Table 3.5). Figure 3.6 displays the mean number of cues provided at each cueing level and the mean RI productions at each cueing level for DA2 for the ASD-HI subgroup.

Table 3.4: ASD-HI subgroup's means and standard deviations for number of cues provided at each cueing level and RI productions at each cueing level for DA1 and DA2

Cueing Level	DA1			
	Number of Cues Provided	RI Productions	Number of Cues Provided	RI Productions
	Mean		Standard Deviation	
Cueing Level 1	11.66$_a$	3.83$_b$	3.20	2.64
Cueing Level 2	6.83$_a$	.00$_b$	2.79	.00
Cueing Level 3	5.66$_a$	2.33$_b$	2.07	1.51
Cueing Level 4	1.83$_a$	1.00$_a$	.98	.89
	DA2			
Cueing Level 1	11.83$_a$	6.33$_b$	2.64	3.27
Cueing Level 2	5.33$_a$	.00$_b$	1.37	.00
Cueing Level 3	4.00$_a$	2.33$_a$	2.53	1.86
Cueing Level 4	1.33	1.33	1.63	1.63

Note. Means with different subscripts differ significantly at $p < .05$ in independent t test comparisons. As indicated above, a t test comparison of cueing level 4 during DA2 could not be completed as the standard error equals zero.

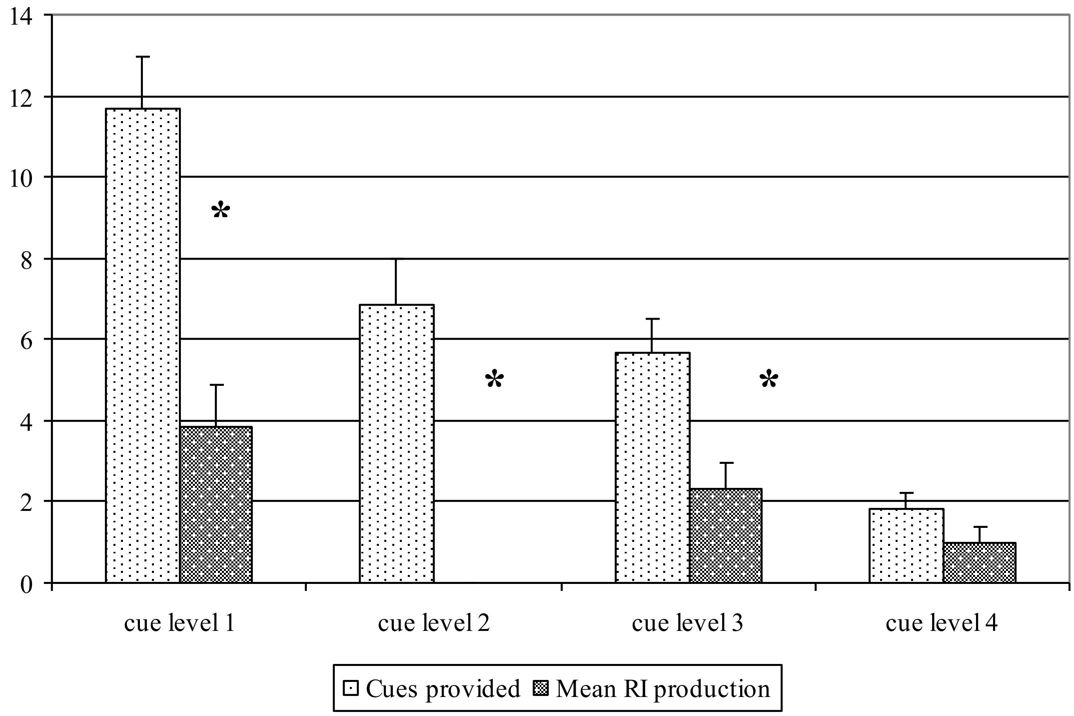

Figure 3.5: ASD-HI subgroup's mean number of cues provided at each cueing level and mean RI productions at each cueing level for DA1

Bonferonni adjusted *$p < .05$

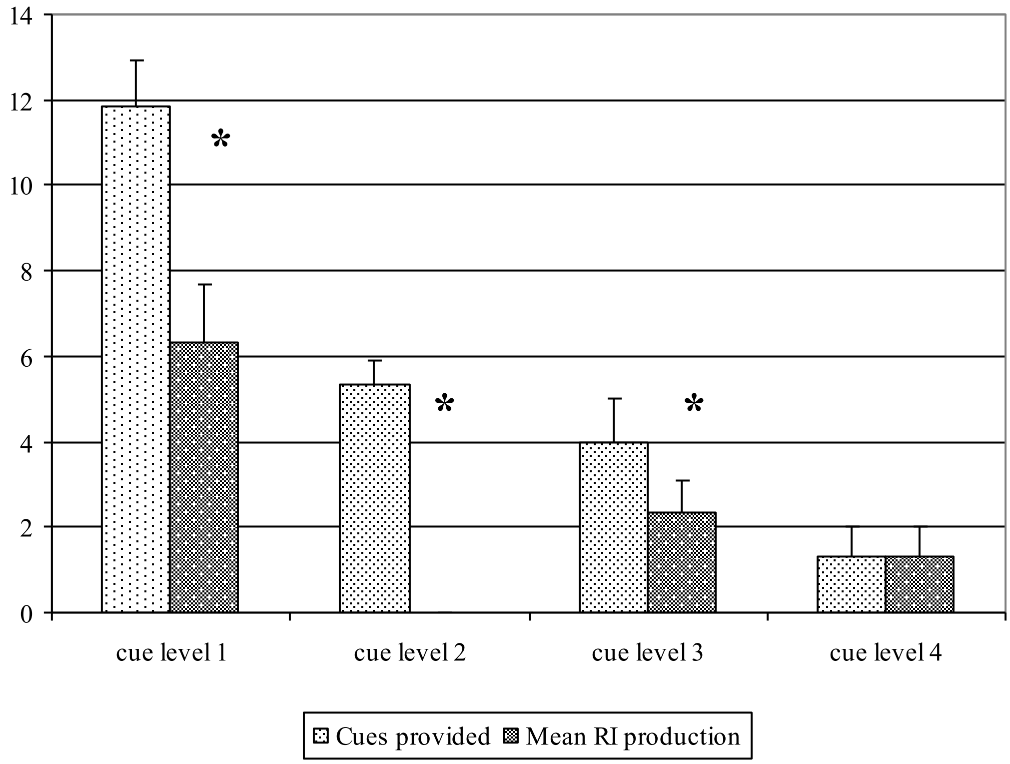

Figure 3.6: ASD-HI subgroup's mean number of cues provided at each cueing level and mean RI productions at each cueing level for DA2

Bonferonni adjusted *$p < .05$

For the ASD-LOW subgroup, paired *t* tests comparing cues provided to the mean number of RI productions at each cue level for DA1 indicated that the ASD-LOW subgroup received significantly more cues at each cue level than resulted in RI productions at each level except level 4. Table 3.5 displays the means and standard deviations for the number of cues provided at each cueing level and the RI productions at each cueing level for DA1 and DA2 for the ASD-LOW subgroup. The paired *t* test results for each cueing level for DA1 are as follows (using a Bonferonni adjusted critical value of $\pm\ _{1\text{-}.05/4}t_{7} = \pm\ 3.321$): cueing level 1, $t(7) = 7.08$, $p = .000$; cueing level 2, $t(7) = 6.631$, $p = .000$; cueing level 3, $t(7) = 3.851$, $p = .006$; and, cueing level 4, $t(7) = 1.00$, $p = .351$. These results indicate that the children in the ASD-LOW subgroup received significantly more cues than they responded to at cueing levels 1, 2, and 3. Figure 3.7 displays the mean number of cues provided at each cueing level and the mean RI productions at each cueing level for DA1 for the ASD-LOW subgroup.

Using the same Bonferroni adjusted critical value for DA2, paired *t* tests indicated that children with ASD received significantly more cues at each cue level than resulted in RI productions at each level except level 4. The paired *t* test results for each cueing level for DA2 are as follows: cueing level 1, $t(7) = 10.00$, $p = .000$; cueing level 2, $t(7) = 10.745$, $p = .000$; cueing level 3, $t(7) = 3.949$, $p = .006$; and, cueing level 4, $t(7) = 1.528$, $p = .170$. Similar to DA1, during DA2 children in the ASD-LOW subgroup received significantly more cues than resulted in RI productions at cueing levels 1, 2, and 3. Figure 3.8 displays the mean number of cues provided at each cueing level and the mean RI productions at each cueing level for DA2 for the ASD-LOW subgroup.

Table 3.5: ASD-LOW subgroup's means and standard deviations for number of cues provided at each cueing level and RI productions at each cueing level for DA1 and DA2

Cueing Level	DA1			
	Number of Cues Provided	RI Productions	Number of Cues Provided	RI Productions
	Mean		Standard Deviation	
Cueing Level 1	13.75_a	4.5_b	5.26	1.86
Cueing Level 2	9.00_a	$.25_b$	3.59	.71
Cueing Level 3	6.13_a	3.00_b	2.36	1.85
Cueing Level 4	2.38_a	2.25_a	2.39	2.19
	DA2			
Cueing Level 1	13.88_a	4.25_b	2.70	2.12
Cueing Level 2	9.25_a	$.00_b$	2.43	.00
Cueing Level 3	6.25_a	2.75_b	2.82	2.19
Cueing Level 4	2.75_a	2.50_a	2.25	2.45

Note. Means with different subscripts differ significantly at $p < .05$ in independent t test comparisons.

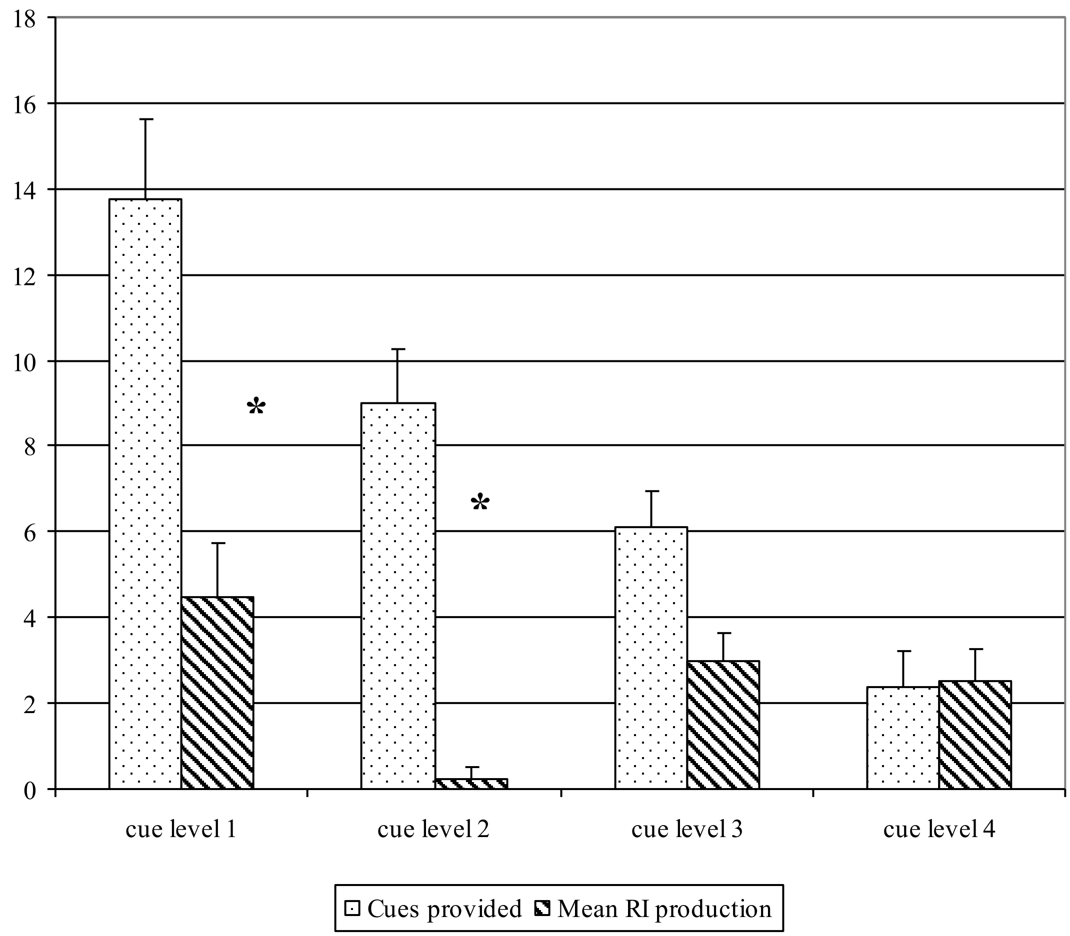

Figure 3.7: ASD-LOW subgroup's mean number of cues provided at each cueing level and mean RI productions at each cueing level for DA1

Bonferonni adjusted *$p < .05$

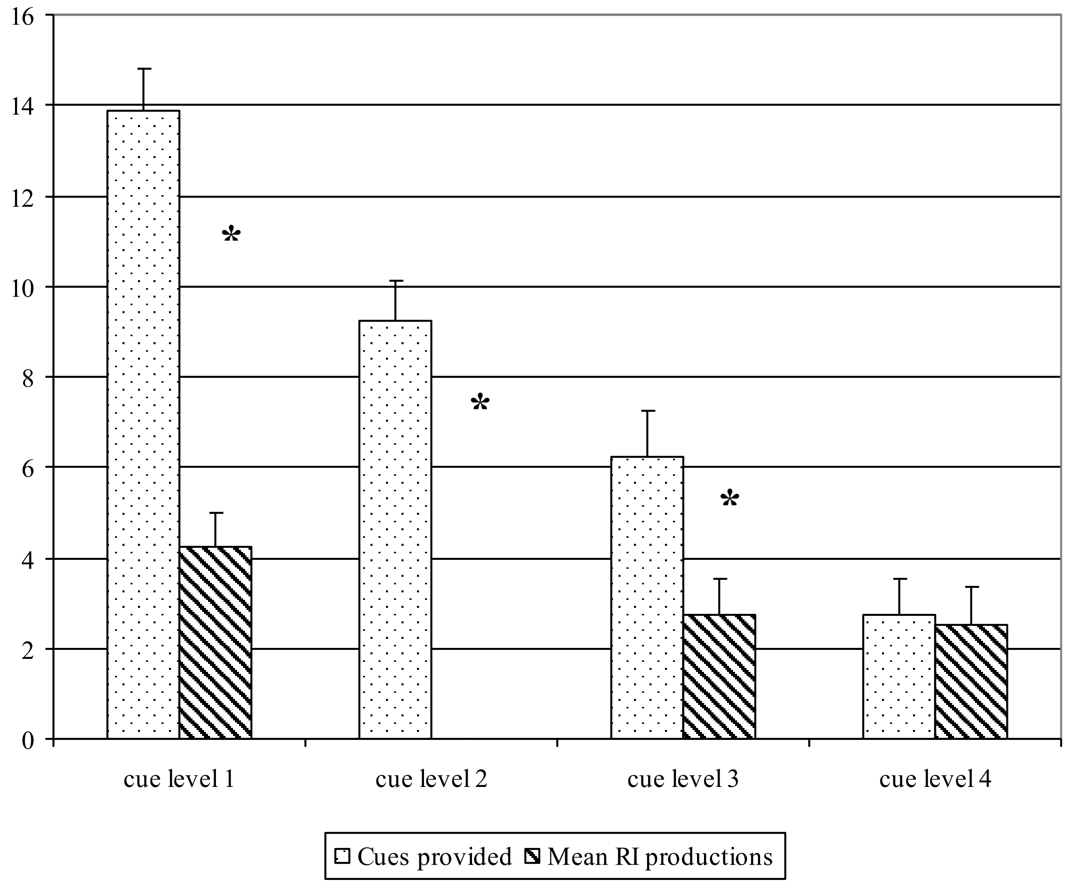

Figure 3.8: ASD-LOW subgroup's mean number of cues provided at each cueing level and mean RI productions at each cueing level for DA2

*Bonferroni adjusted $p < .05$

Question 4c: For ASD subgroups, during DA, which cueing level appears to be most effective and which cueing level appears to be least effective in facilitating production of RI, as measured by the percentage of cues that resulted in a RI production at each cueing level?

The percentage of cues that resulted in a RI production for each cueing level was used to address this question. To determine the subgroup's mean percentage of cues that resulted in a RI production for each cueing level, each participant's percentage of cues that resulted in a RI production was summed for each cueing level and divided by the number of participants in the subgroup.

For the ASD-HI subgroup, the Bonferroni adjusted critical value ($\pm {}_{1-.05/6}t_5 = \pm 4.197$) was compared to the standard *t* test values in order to detect significant differences in the percentage of cues that resulted in a RI production at each cueing level of DA1 for the following contrasts: cueing level 1 compared to cueing level 2; cueing level 1 compared to cueing level 3; cueing level 1 compared to cueing level 4; cueing level 2 compared to cueing level 3; cueing level 2 compared to cueing level 4; cueing level 3 compared to cueing level 4. The same comparisons were also made for DA2. The Bonferroni adjusted critical value of $\pm {}_{1-.05/6}t_7 = \pm 3.620$ was used to make the same subgroup comparisons for the ASD-LOW subgroup.

For DA1, paired *t* test comparisons revealed no statistically significant differences between all comparisons for the ASD-HI subgroup except for between cueing level 2 and cueing level 3. Children in the ASD-HI subgroup responded to significantly fewer cues at cueing level 2 (M = .00, SD = .00) than at cueing level 3 (M = 41.53, SD = 20.75), $t(5) = -4.902$, $p = .004$. Further paired t test comparisons revealed no statistically significant differences (as compared to the Bonferroni critical value) between at the percentage of cues that resulted in a RI production comparisons at cueing level 1 (M = 32.06, SD = 20.13) compared to cueing level 2 (M = .00, SD = .00), $t(5) = 3.901$, $p = .011$; cueing level 1 compared to cueing level 3 (M = 41.53, SD = 20.75), $t(5) = -1.096$, $p = .323$; cueing level 1 compared to cueing level 4 (M = 50.00, SD = 45.95) $t(5) = -.868$, $p = .425$; cueing level 2 to cueing level 4, $t(5) = -2.666$, $p = .045$; and, cueing level 3 and cueing level 4, $t(5) = -.340$, $p = .748$. In other words, during DA1 children in the ASD-HI subgroup were most responsive to cueing level 3 (indirect cue) and least responsive to cueing levels 1 (no cue), 2 (peer / adult model), and 4 (direct cue); therefore, it appears that cueing level 3 was most effective in facilitating RI productions, while cueing level 2 was least effective. Figure 3.9 displays the ASD-HI subgroup's mean percentage of cues that resulted in a RI production for each cueing level during DA1.

For DA2, paired t test comparisons revealed that children in the ASD-HI subgroup responded (by producing a RI) to significantly more cues at cueing level 1 (M = 51.20, SD = 17.97) than at cueing level 2 (M = .00, SD = .00), $t(5) = 6.978$, $p = .00$; responded to significantly fewer cues at cueing level 1 than at cueing level 4 (M = 100.00, SD = .00), $t(10) = -6.651$, $p = .001$; and, responded to significantly fewer cues at cueing level 2 than at cueing level 3 (*M* = 65.87, *SD* = 36.81), *t*(5) = -4.383, *p* = .007. Further paired *t* test comparisons revealed no statistically significant differences (as compared to the Bonferroni critical value) between at the percentage of cues that resulted in a RI production at cueing level 1 compared to cueing level 3, *t*(5) = -.831, *p* = .444. Comparison between cueing level 2 (*M* = .00, *SD* = .00) and cueing level 4 (*M* = 100.00, *SD* = .00) could not be computed because the standard error of the difference was zero; however the difference between the two cueing levels is apparent through visual inspection of the mean statistic. Thus, during DA2 children in the ASD-HI subgroup were most responsive to cueing 4 (direct cue), and least responsive to cueing level 2 (peer / adult model); therefore, it appears that cueing level 4 was most effective at facilitating RI productions and cueing level 2 was least effective. Figure 3.9 displays the ASD-HI subgroup's mean percentage of cues that resulted in a RI production for each cueing level during DA1.

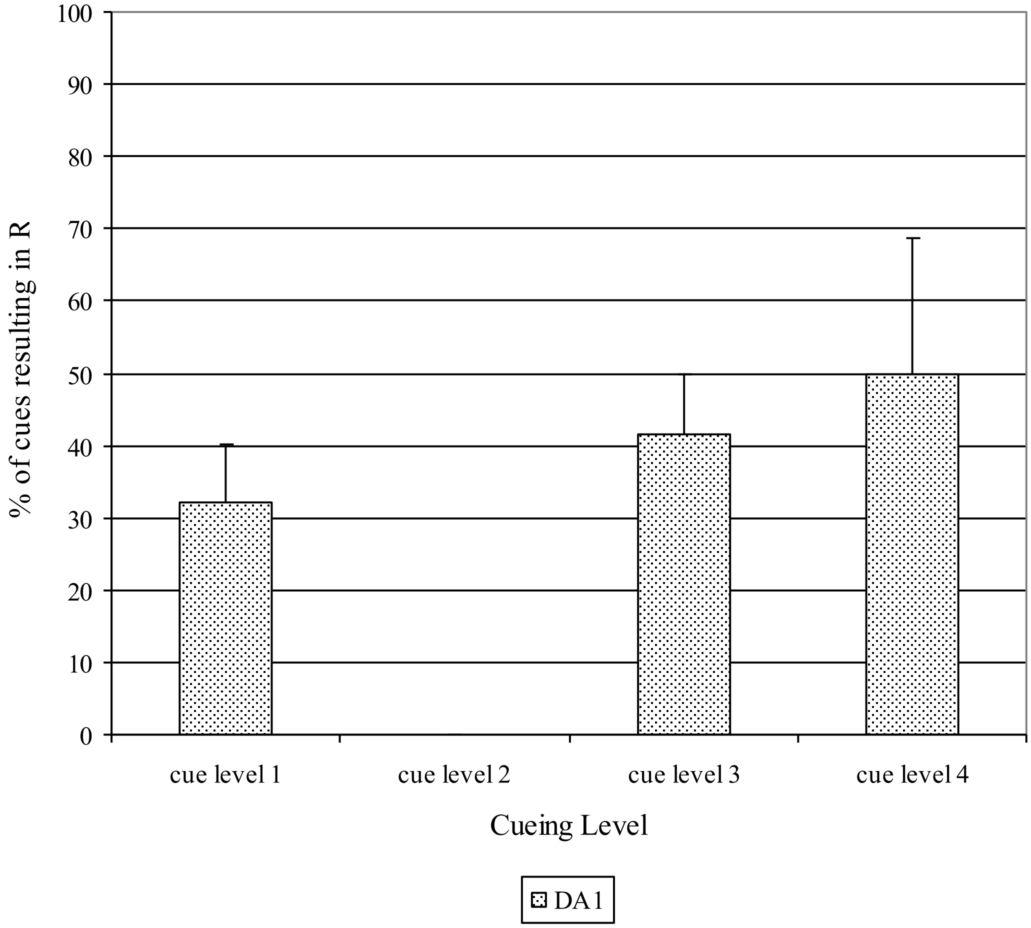

Figure 3.9: ASD-HI subgroup's mean percentage of cues that resulted in a RI production for each cueing level during DA1

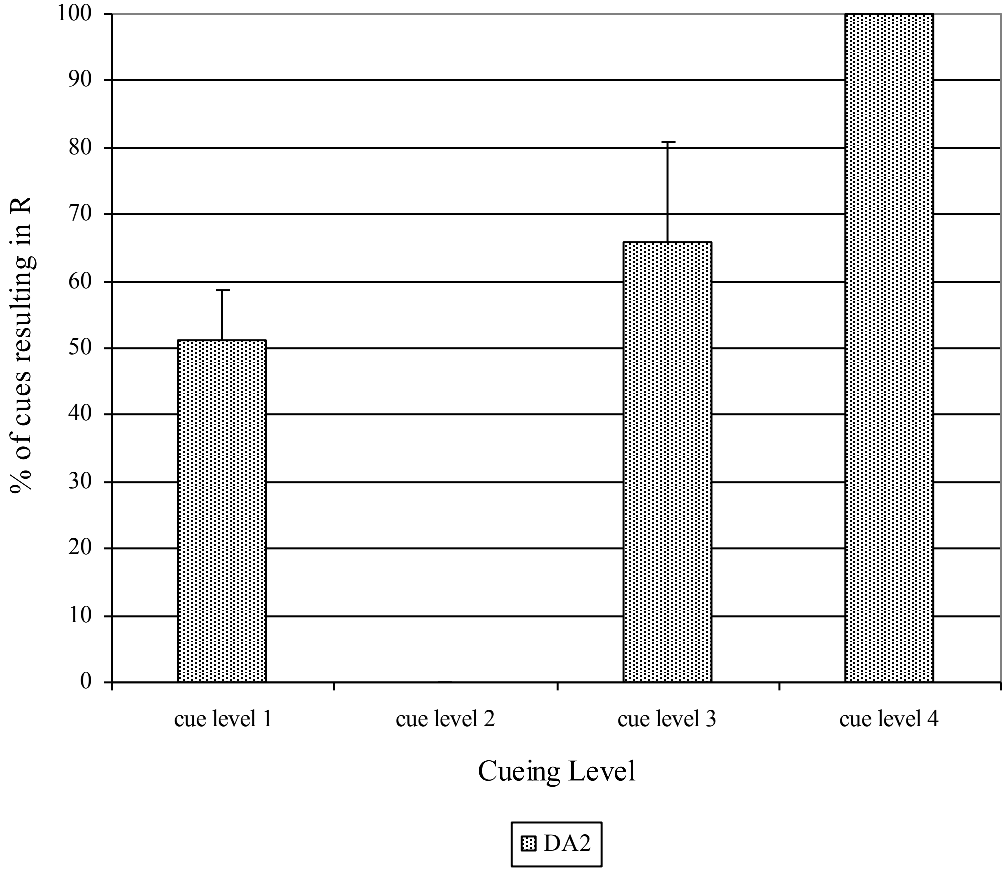

Figure 3.10: ASD-HI subgroup’s mean percentage of cues that resulted in a RI production for each cueing level during DA2

For the ASD-LOW subgroup the Bonferroni adjusted critical value of $\pm\, {}_{1-.05/6}t_{7} = \pm\, 3.620$ was used to compare standard paired *t* test values. DA1 comparisons revealed that children in the ASD-LOW subgroup responded to significantly more cues at cueing level 1 (M = 31.88 SD = 16.06) than at cueing level 2 (M = 3.13, SD = 8.84), $t(7) = 5.066$, $p = .001$; and the ASD-LOW subgroup responded to significantly fewer cues at cueing level 1 than at cueing level 4 (M = 97.92, SD = 5.89), $t(7) = -12.583$, $p = .000$; at cueing level 2 than at cueing level 3 (M = 3.13, SD = 8.84), $t(7) = -5.844$, $p = .001$; at cueing level 2 than at cueing level 4, $t(7) = -27.086$, $p = .000$; and at cueing level 3 than at cueing level 4, $t(7) = -5.306$, $p = .001$. A paired *t* test comparison between cueing level 1 and cueing level 3 revealed no statistically significant difference in performance (as compared to the Bonferroni critical value), $t(7) = -2.218$, $p = .062$. During DA1 children in the ASD-LOW subgroup were most responsive to cueing levels 3 (indirect cue) and 4 (direct cue), while least responsive to cueing level 2 (peer / adult model). Figure 3.11 displays the ASD-LOW subgroup's mean percentage of cues that resulted in a RI production for each cueing level during DA1.

For DA2, paired *t* test comparisons revealed that children in the ASD-LOW subgroup responded (by producing a RI) to significantly more cues at cueing level 1 (M = 30.57, SD = 16.54) than at cueing level 2 (M = .00, SD = .00), $t(7) = 5.228$, $p = .001$; responded to significantly fewer cues at cueing level 2 than at cueing level 3 (M = 44.20, SD = 25.63), $t(7) = -4.878$, $p = .002$; and, responded to significantly fewer cues at cueing level 2 than at cueing level 4 (*M* = 81.25, *SD* = 37.20), $t(7) = -6.177$, $p = .000$. Further paired *t* test comparisons revealed no statistically significant differences (as compared to the Bonferroni critical value) between at the percentage of cues that resulted in a RI production at cueing level 1 compared to cueing level 3, $t(7) = -1.298$, $p = .235$; between cueing level 1 and cueing level 4, $t(7) = -3.194$, $p = .015$; and between cueing level 3 and cueing level 4, $t(7) = -2.153$, $p = .068$. During DA2 children in the ASD-LOW subgroup were most responsive to cueing level 4 (direct cue), and least responsive to cueing level 2 (peer / adult model); therefore, it appears that cueing level 4 was most effective at facilitating RI productions and cueing level 2 was least effective. Figure 3.12 displays the ASD-LOW subgroup's mean percentage of cues that resulted in a RI production for each cueing level during DA2.

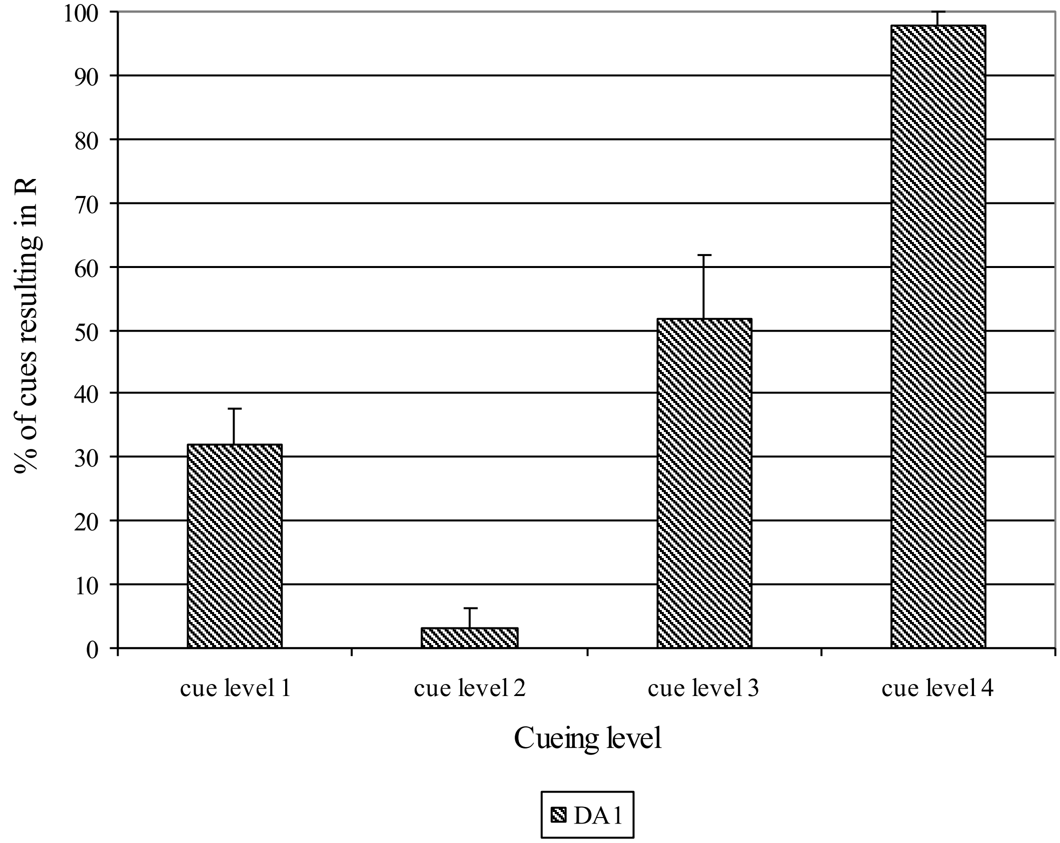

Figure 3.11: ASD-LOW subgroup's mean percentage of cues that resulted in a RI production for each cueing level during DA1

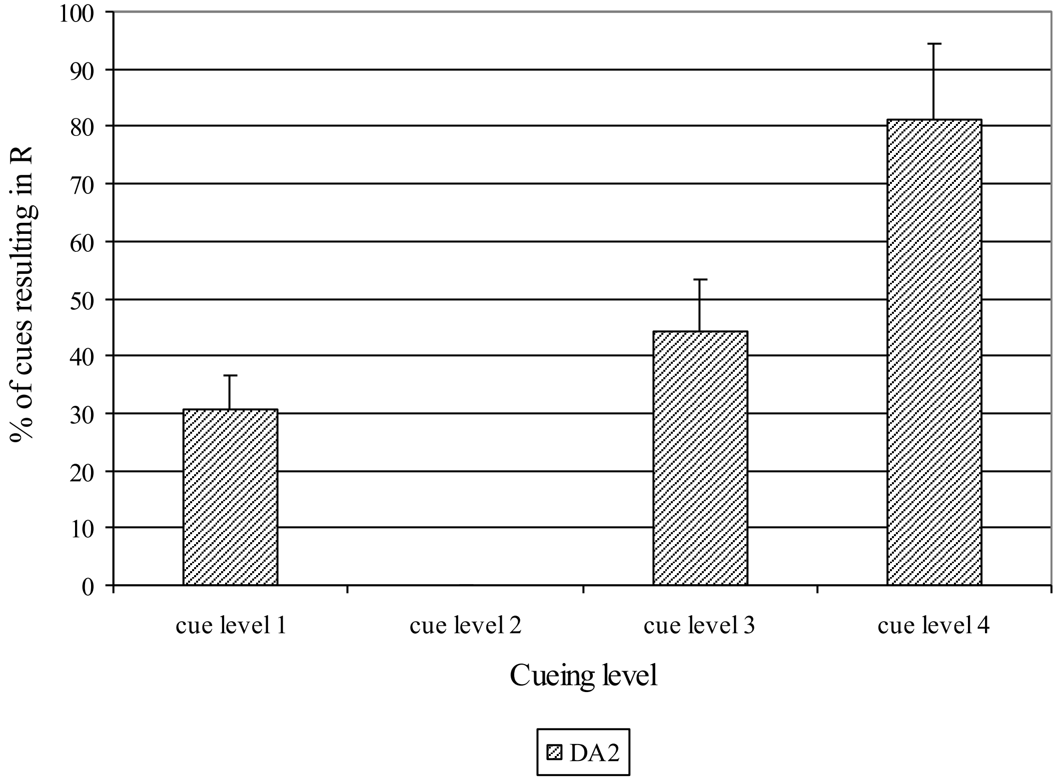

Figure 3.12: ASD-LOW subgroup's mean percentage of cues that resulted in a RI production for each cueing level during DA2

Possible Change in Production of RI

This section presents a within (sub)group comparison of productions of RI over all SA sessions to determine the transfer effects, if any, of DA on production of RI.

Question 5a: Do children within each ASD subgroup and within the TDP group demonstrate a change in production of RI, as measured by RI production-opportunity ratio, across SA sessions? Each (sub)group's mean RI production-opportunity ratio for each SA session was used to address this question. The following within (sub)group analyses were made: the RI production-opportunity ratio for SA1 was compared with SA2; the RI production-opportunity ratio for SA2 was compared with SA3; and, the RI production-opportunity ratio for SA1 was compared with SA3.

For the ASD-HI subgroup, the Bonferroni adjusted critical value ($\pm\ _{1-.05/3}t_5 = \pm\ 3.518$) was compared to the standard paired *t* test values in order to detect significant differences between RI production-opportunity ratios for SA sessions within subgroup. Paired *t* test comparisons revealed no statistically significant differences between the ASD-HI subgroup's mean RI production-opportunity ratio for SA1 (M = 51.89, SD = 15.46) and SA2 (M = 56.08, SD = 24.25), $t(5) = -.536$, $p = .615$; between the mean RI production-opportunity ratio for SA2 and SA3 (M = 61.02, SD = 22.61), $t(5) = -.401$, $p = .705$; and between the mean RI production-opportunity ratio for SA1 and SA3, $t(5) = -.819$, $p = .450$. That is, the ASD-HI subgroup performed similarly across all SA sessions.

The Bonferroni adjusted critical value ($\pm\ _{1-.05/3}t_{7} = \pm\ 3.115$) was compared to the standard paired *t* test values in order to detect significant differences in RI production-opportunity ratios within the ASD-LOW subgroup. Paired *t* test comparisons revealed no statistically significant differences between the ASD-LOW subgroup's mean RI production-opportunity ratio for SA1 ($M = 34.94$, SD = 21.87) and SA2 ($M = 55.60$, $SD = 23.64$), $t(7) = -1.844$, $p = .108$; between the mean RI production-opportunity ratio for SA2 and SA3 ($M = 61.02$, $SD = 22.61$), $t(7) = .847$, $p = .425$; and between the mean RI production-opportunity ratio for SA1 and SA3, $t(7) = -.964$, $p =.367$. In other words, the ASD-LOW subgroup performed similarly across all SA sessions.

The Bonferroni adjusted critical value ($\pm\ _{1-.05/3}t_{9} = \pm\ 2.923$) was compared to the standard paired *t* test values in order to detect significant differences in RI production-opportunity ratios within the TDP group. Paired *t* test comparisons revealed no statistically significant differences between the TDP group's mean RI production-opportunity ratio for SA1 ($M = 67.14$, SD = 17.38) and SA2 ($M = 66.39$, $SD = 23.79$), $t(9) = .111$, $p = .914$; between the mean RI production-opportunity ratio for SA2 and SA3 ($M = 63.82$, $SD = 17.10$), $t(9) = .299$, $p = .772$; and between the mean RI production-opportunity ratio for SA1 and SA3, $t(9) =$

.845, p =.420. As with the ASD subgroups, the TDP group performed similarly across all SA sessions.

Question 5b: Do children within each ASD subgroup and within the TDP group demonstrate a change in unelicited performance, as measured by the free-play RI rate, across SA sessions? Each (sub)group's mean free play RI rate for each SA session was used to address this question. Recall that individual free play RI rates were calculated by dividing the number of RIs produced during free play by the total number of minutes during the free-play period (5 minutes). The free play RI rate represents the rate of RI productions that were not elicited by the principal investigator during each session.

To determine each (sub)group's mean free play RI rate for each session, the free play RI rates from all participants in the (sub)group were summed and divided by the number of participants in the (sub)group. The (sub)group's mean free play RI rate from each session was then compared within groups as follows: the mean free play RI rate for SA1 was compared with SA2; the mean free play RI rate for SA2 was compared with SA3; and, the mean free play RI rate for SA1 was compared with SA3.

For the ASD-HI subgroup, the Bonferroni adjusted critical value ($\pm {}_{1-.05/3}t_5 =$ $\pm$ 3.518) was compared to the standard paired t test values in order to detect significant differences between free play RI rates for SA sessions within the ASD-

HI subgroup. Paired *t* test comparisons revealed no statistically significant differences between the ASD-HI subgroup's mean free play rate for SA1 (*M* = .56, *SD* = .34) and SA2 (*M* = .27, *SD* = .27), *t*(5) = 2.423, *p* = .060; between the mean free play rate for SA2 and SA3 (*M* = .23, *SD* = .27), *t*(5) = .176, *p* = .867; and between the mean free play rate for SA1 and SA3, *t*(5) = 2.076, *p* = .093. That is, the ASD-HI subgroup performed similarly across the free-play portion of all SA sessions.

For the ASD-LOW subgroup, the Bonferroni adjusted critical value ($\pm {}_{1-.05/3}t_{7} = \pm 3.115$) was compared to the standard paired *t* test values in order to detect significant differences between free play RI rates for SA sessions within the ASD-LOW subgroup. Paired *t* test comparisons revealed that children in the ASD-LOW subgroup produced a significantly lower rate of RI during the free play period of SA1 (*M* = .00, *SD* = .00) as compared to SA2 (*M* = .55, *SD* = .46), *t*(7) = -3.361, *p* = .012. Further paired *t* test comparisons revealed no statistically significant differences between the ASD-LOW subgroup's mean free play rate for SA2 and SA3 (*M* = .33, *SD* = .30), *t*(7) = 1.180, *p* = .276; and between the mean free play rate for SA1 and SA3, *t*(7) = -3.052, *p* = .019. In other words, children in the ASD-LOW produced a higher rate of RI during the free play portion of SA2 than during the free play portion of SA1; however, they performed similarly across all other SA comparisons.

The Bonferroni adjusted critical value ($\pm\ _{1-.05/3}t_{10} = \pm\ 2.860$) was compared to the standard paired *t* test values in order to detect significant differences in free play RI rates for SA sessions within the TDP group. Paired *t* test comparisons revealed no statistically significant differences between the TDP group's mean free play RI rate for SA1 (*M* = .42, SD = .30) and SA2 (*M* = .31, *SD* = .36), *t*(10) = .645, *p* = .534; between the mean free play RI rate for SA2 and SA3 (*M* = .33, *SD* = .27), *t*(10) = -.124, *p* = .904; and between the mean free play RI rate for SA1 and SA3, *t*(10) = .922, *p* =.378. The TDP group performed similarly across the free-play portion of all SA sessions.

Summary of Results

Table 3.6 presents the study's research questions and summarizes the results for each question.

Table 3.6: Summary of results

Research Question	Results
Question 1: Do more able children with ASD differ from TDP across each session during SA1 with regard to production of RI, as measured by RI production-opportunity ratio and RI rate?	Yes and No. During SA1, children in the general ASD group produced significantly fewer RI (as measured by both RI production-opportunity ratio and RI rate) than TDP. Further analysis of the ASD subgroup performance during SA1 revealed that the ASD-LOW subgroup produced significantly fewer RI compared to the TDP group, while the ASD-HI subgroup performed similarly to the TDP group. Both the ASD and TDP groups demonstrated a wide range of performance with regard to RI productions during SA1.

Table 3.6 (continued)

Question 2: Does production of RI, as measured by RI production-opportunity ratio, during each session of the SA condition (SA1, SA2, SA3) differ from production of RI during the DA condition (DA1 and DA2 combined) within ASD subgroups and within the TDP group?	Yes and No for children with ASD. Children in the ASD-LOW subgroup produced significantly fewer RI (as measured by the RI production-opportunity ratio) during SA1 than during the DA condition (both DA sessions combined); however, children in the ASD-HI group performed similarly across these assessments. For all children with ASD, performance across SA2 and the DA condition and across SA3 and the DA condition were similar. No for TDP. The TDP group demonstrated similar performance across both SA and DA conditions.

Table 3.6 (continued)

Question 3a: Does the contextual manipulation of making available highly-preferred objects/activities influence production of RI, as measured by RI production-opportunity ratio, for both groups (within ASD subgroups, within the TDP group, between the ASD subgroups and the TDP group, and between the ASD subgroups)?	Within (sub)groups No. Within ASD subgroup and within TDP group comparisons revealed that both the ASD-HI and ASD-LOW subgroups performed similarly across SA1 and SA2; the TPD group also performed similarly across SA1 and SA2. Between (sub)groups Yes and No. Children in the ASD-LOW subgroup produced significantly fewer RI than children in the TDP group during SA1 (availability of only typical objects/activities), but performance between was similar for SA2 (availability of highly-preferred objects/activities). Between group comparisons of the ASD-HI subgroup and the TDP group and the between two ASD subgroups revealed similar performance for SA1 and SA2.

Table 3.6 (continued)

Question 3b: Does the contextual manipulation of changing physical settings (the classroom vs. the treatment room) influence production of RI, as measured by RI production-opportunity ratio, for both groups (within ASD subgroups, within the TDP group, between ASD subgroups and the TDP group, and between ASD subgroups)?	Within (sub)group No. Within ASD subgroup and within TDP group comparisons revealed that all groups performed similarly across DA1 and DA2. Between (sub)group No. Between group comparisons of the ASD-HI subgroup and the TDP group revealed no significant differences in performance; this was also true for ASD-LOW and TDP comparisons. Between ASD subgroup comparisons revealed that both subgroups performed similarly to across DA1 and DA2.
Question 4a: Do ASD subgroups differ from the TDP group across DA sessions with regard to average cueing level necessary to facilitate production of RI, as measured by the session production cueing ratio?	Yes and No. Both ASD subgroups received a similar average level of cueing per production of RI as the TDP group during both DA1 and DA2. However, the ASD-LOW subgroup required a higher average level of cueing to produce RI than the ASD-HI group during DA2.

Table 3.6 (continued)

Question 4b: During DA, how responsive are the ASD subgroups to cues at each cueing level, as measured by the subgroup's mean cues provided at each cueing level and the subgroup's mean RI productions at each cueing level?	Children in the ASD-HI subgroup required significantly more cues at cueing levels 1, 2, and 3 than resulted in RI productions during DA1. During DA2, the group required significantly more cues than resulted in RI productions at cueing levels 1and 2. The ASD-LOW subgroup required significantly more cues than resulted in RI productions for cueing levels 1, 2, and 3 for both DA1 and DA2.
Question 4c: For ASD subgroups, during DA, which cueing level appears to be most effective and which cueing level appears to be least effective in facilitating production of RI, as measured by the percentage of cues that resulted in a RI production at each cueing level?	For the ASD-HI subgroup, cueing level 3 (indirect cue) appeared the most effective at facilitating production of RI, while cueing level 2 (peer / adult model) appeared least effective during DA1. However, during DA2, the ASD-HI subgroup was most responsive to cueing level 4 (direct cue) and least responsive to cueing level 2 (peer / adult model). For the ASD-LOW subgroup, cueing level 4 was most effective at facilitating production of RI, while cueing level 2 was least effective during both DA1 and DA2.

Table 3.6 (continued)

Question 5a: Do children within each ASD subgroup and within the TDP group demonstrate a change in production of RI, as measured by RI production-opportunity ratio, across SA sessions?	No. All within ASD subgroup comparisons revealed similar performance across all SA sessions. Within TDP group comparisons also revealed similar performance across all SA sessions.
Question 5b: Do children within each ASD subgroup and within the TDP group demonstrate a change in unelicited performance, as measured by the free-play RI rate, across SA sessions?	Yes and No. Within ASD-HI subgroup comparisons revealed similar unelicited performance across all SA sessions; however, the ASD-LOW subgroup demonstrated a lower RI rate of production during SA1 as compared to SA2. ASD-LOW unelicited performance across all other SA sessions was similar. The TDP group demonstrated similar within group performance across the free-play periods of all SA sessions.

CHAPTER IV: DISCUSSION

The overarching purpose of this investigation was to quantify the production of RI by more able children with ASD and their typically developing peers and to examine the potential influence of environmental factors (contextual and linguistic variables) on performance. This was accomplished by systematically manipulating contextual and linguistic variables across two assessment conditions (static and dynamic assessment). To provide a framework for discussing the investigation's results, the following topics are presented: a description of production of RI by the TDP group and both ASD subgroups, which is intended to inform our understanding of the nature of RI and contribute to the social-communicative profile of more able children with ASD; a discussion of the role of the environment on production of RI, including the influence of contextual and linguistic variable manipulations on performance; a discussion of the assessment methodologies; and finally, summary and future directions. Clinical implications are discussed throughout these topics.

Requests for Information

In order to learn more about the nature of RI, one must consider the performance of the TDP group, as well as more able children with ASD. Describing the production of RI by the TDP group will inform our understanding of the everyday use of this social-communicative behavior within natural environments. Describing the production of RI by more able children with ASD will further inform our understanding of the social-communicative profile of these children.

Typically Developing Peers

Typically developing peers demonstrated similar performance across all assessment sessions. Recall that within group comparisons revealed no statistically significant differences in production of RI as measured by the group's mean RI production-opportunity ratio. One of the most interesting findings with regard to the nature of RI was the wide variability in production demonstrated by this group (see Table 3.2). For example, during SA2 one participant in the TDP group produced an RI for only 25% of the opportunities presented, even when provided with elicitation techniques; whereas, during that same assessment session (SA2) another participant in this group produced a RI for 100 percent of the RI opportunities. These findings are important in that they suggest the production of RI can be inconsistent and variable among typically developing children within the natural environment.

More Able Children with ASD

Within group comparison. In order to compare the production of RI by more able children with ASD with that of the TDP group, one must first consider performance within the ASD group. Within group comparisons revealed that, unlike the TDP group, more able children with ASD group did not demonstrate similar production of RI across assessment sessions. Indeed, the ASD group produced significantly fewer RI productions during SA1 than during the DA condition. However, closer examination of subgroup performance revealed that it was the children in the low RI performer group (ASD-LOW) who produced significantly fewer RI during SA1 than during the DA condition, while children in the high RI performer group (ASD-HI) actually performed similarly with regard to RI production across all assessment sessions. In other words, similar to the TDP group, the ASD-HI subgroup demonstrated similar performance across all assessment sessions. Whereas the ASD-LOW subgroup's performance indicated that the manipulation of environmental variables facilitated their production of RI. This will be discussed further below.

Between group comparison. Previous research has targeted increasing the production of RI by more able children with ASD, but there have been no group study comparisons of a TDP group from within the same social/learning environment (e.g., classroom). Measuring the production of RI by the TDP group assists in establishing a baseline of expected or *typical* performance in a Kindergarten or First Grade classroom. This TDP baseline can then be compared to the performance of more able children with ASD to determine if more able children with ASD warrant intervention to increase production of RI.

Between (sub)group comparisons of RI production-opportunity ratios revealed that the ASD-HI subgroup and TDP group demonstrated similar performance across all assessment sessions. However, the ASD-LOW group produced significantly fewer RI than the TDP group during SA1. These results suggest that the ASD-HI subgroup does not present with a deficit in production of RI, as compared to typical peers, while the ASD-LOW subgroup does. In other words, unlike previously suggested, not all more able children with ASD demonstrate difficulty with production of RI in the natural environment as compared with their typical peers. Figure 4.1 presents each (sub)group's mean RI production-opportunity ratio for all assessment sessions.

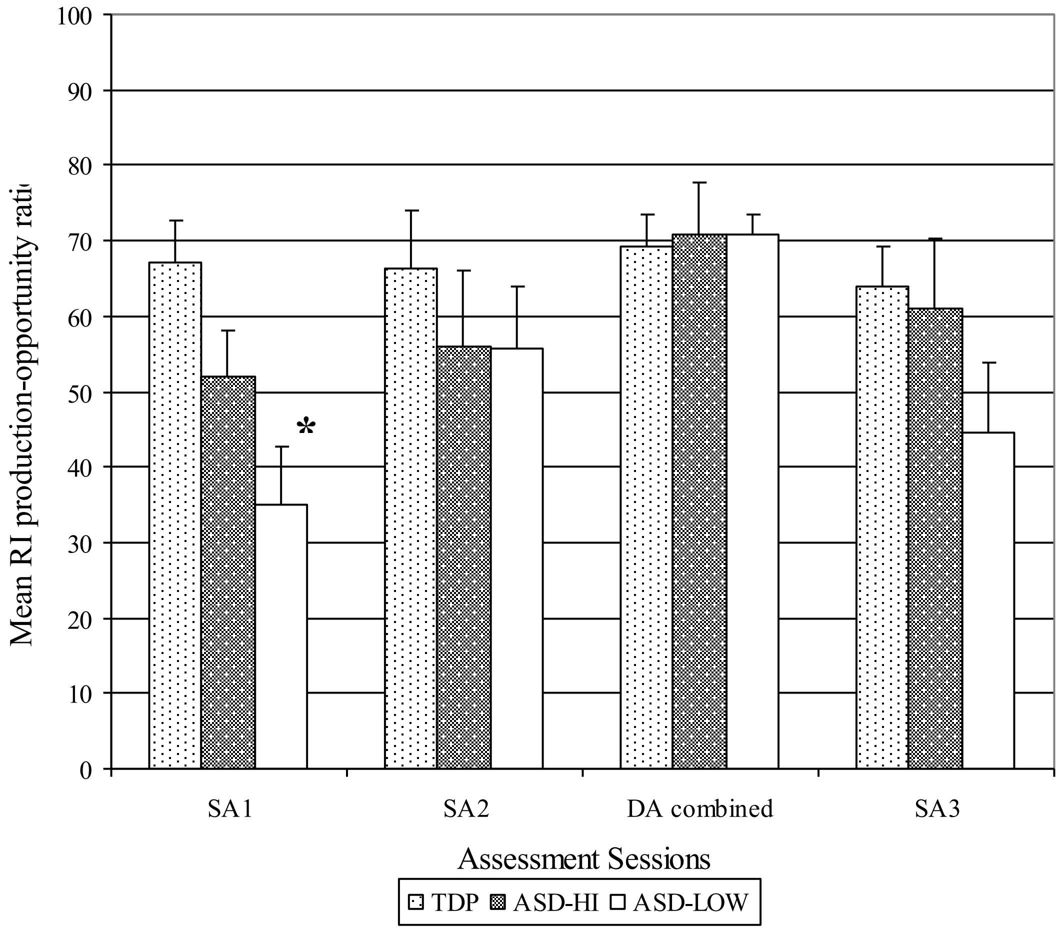

Figure 4.1: ASD subgroups and TDP group mean RI production-opportunity ratios across all assessment sessions

These findings have several clinical implications. First, given the performance variability among more able children with ASD with regard to RI production (i.e., between ASD-HI and ASD-LOW subgroups), clinical assessments should include a comparison to relevant typically developing peers. Such comparison will assist in determining if the more able child with ASD truly presents with a RI production deficit. This supports previous research by Olswang, Kriegsmann, & Mastergeorge, 1982); in a case study of a child with pragmatic impairments, the production of requests by classroom peers was used as a baseline from which to compare the performance of the target child. The target child's requesting deficits, as compared to his classroom peers performance, served as a rationale for initiating treatment to increase his use of requests in the classroom.

Second, continued comparison of the target child's RI production with that of his/her classroom peers can inform intervention planning. That is, during intervention, the typical peer performance can serve as the "goal"; providing a criterion for determining when the child receiving services has achieved a comparable level of RI productions in the natural environment and thus might discontinue treatment.

In summary, just over half of this study's sample of more able children with ASD actually presented with RI production deficits when compared with typical peers. Because RI serves many purposes that assist in learning from one's environment, further understanding of the use of RI by typically developing peers within the natural environment is important.

The RI production variability demonstrated by the TDP group in the current study suggests that even typically developing children do not take advantage of all opportunities to request information. However, it is not simply a matter of responding to RI opportunities. Indeed, children, like adults, decide what information they will seek out and from whom. As would be expected, the child's motivation to gain the information is a factor, as is the child's understanding of whether or not his/her communication partner has the information that is sought. In addition, requesting information is also a means by which one demonstrates interest in another person's thoughts, opinions, actions and feelings. Given the number of factors that influence a child's production of RI, it is not surprising that children demonstrate variability in their requests for information. By quantifying the production of RI by typical peers, this study sets an important benchmark from which to compare the performance of more able children with ASD.

Use of this benchmark revealed that children in the ASD-HI subgroup demonstrated similar performance to that of their typical peers. These results suggest that although more able children with ASD (including high RI performers) demonstrate social-communicative deficits such as decreased shared interest and attention, difficulty with conversational reciprocity, and limited social awareness, their production of RI may be more similar to TDP than previously expected. This begs the question, what is the role of RI production in these social-communicative deficits? If children in the ASD-HI subgroup performed similarly to TDP with regard to production of RI, but are still perceived by their classroom teachers as demonstrating social interaction deficits in the classroom, how does production of RI influence the perception of social competence?

Three possible answers are presented. First, perhaps the type of RI produced by the child influences the perception of social competence. A request for information that solely serves the purposes of the speaker (e.g., asking where to find a misplaced item or how to manipulate an object of interest) may differ with regard to its promotion of social interaction, as compared to an RI focusing on personal information about the communication partner (e.g., asking how the listener feels or what interests the listener). More able children with ASD may differ in the types of RI they are producing as compared to typical peers. Given the decreased social interest demonstrated by more able children with ASD, they may demonstrate a greater number of RI productions that are "self-serving" rather than social in nature. Children who produce a greater number of self-serving RI versus socially-motivated RI may be perceived as demonstrating less social competence than those children who produce more socially-motivated RI. Further analysis of the type of RI used by more able children with ASD, as compared to typical peers, is warranted to investigate this issue.

Second, professionals serving children with ASD, including classroom teachers, may not have an accurate picture of the performance of typical peers with regard to production of RI. Perhaps, given limited knowledge about *typical* performance in the classroom to date, professionals have had little opportunity for accurate comparison between TDP and more able children with ASD. Given the other social-communicative deficits demonstrated by more able children with ASD and the variability within this population (and amongst TDP), it is not surprising that professionals might assume that RI production deficits are included in the child's overall social-communicative profile, even if they are not.

Finally, perhaps production of RI does not play a significant role in a child's overall perception of social competence. Given the number of social-communicative deficits demonstrated by more able children with ASD and the fact that production of RI is a relatively low frequency of occurrence behavior, production of RI may not be "on the radar" of professionals when considering the social competence of child with ASD. However, given the importance of RI for learning about one's environment and interacting socially (Schwabe et al, 1986), this seems unlikely.

The ASD-LOW subgroup produced significantly fewer RI during SA1 than the TDP group. Thus, for some more able children with ASD (i.e., low RI performers), RI production deficits do appear to be part of their social-communicative profile and may require intervention. As indicated above, there are many factors that influence production of RI; motivation and interest in others may play a particular role in production of RI by children in the ASD-LOW subgroup. For children who demonstrate limited social interest and interaction, seeking information to express interest in another person or to maintain a conversation with a friend may not be intrinsically motivating. Use of elicitation techniques can ensure that children have ample opportunities to demonstrate the behavior, but do not necessarily increase a child's motivation or interest in others. As such, manipulation of environmental factors may provide the additional support necessary to improve performance for this subgroup.

Environmental Factors

The current study manipulated two different environmental factors (contextual and linguistic variables) to determine their possible influence on production of RI by more able children with ASD (ASD-HI and ASD-LOW subgroups) and their typically-developing peers.

Contextual Variables

Object / Activity Choice. The contextual variable of object/activity choice (typical object/activities and highly-preferred objects/activities) was manipulated across two SA sessions (SA1 and SA2) to determine the possible effects on RI production. Previous research indicates that children with ASD demonstrate increased social interaction when engaging in preferred activities with peers (Baker et al, 1998; LeGoff, 2001). Further, these children demonstrate decreased social interest in peers and the activities of peers, as well as limited topics/activities of interest (Carpenter & Tomasello, 2000; Landa, 2000). As such, in an attempt to facilitate production of RI, highly-preferred objects/activities were presented to draw the interest of more able children with ASD into a common activity with peers (Beilinson & Olswang, 2003).

The current study compared production of RI during a session that made available typical objects/activities in the classroom (SA1) with a session that made available highly-preferred objects/activities in the classroom (SA2). Recall that this contextual variable was purposefully manipulated during the static assessment condition in order to investigate how object/activity preference might influence static performance. That is, although the environment was modified, the child's performance remained independent; the principal investigator did not provide any feedback or prompting to promote production of RI. The RI performance of more able children with ASD reported below speaks to the success of this contextual manipulation.

The ASD-HI subgroup performed similarly to the TDP group, in fact they performed similarly across all assessment sessions. Perhaps children in the ASD-HI subgroup demonstrated relative social-communicative strengths with regard to RI production, or perhaps the use of elicitation techniques alone (i.e., opportunities) played a role in performance. In general, any child may not spontaneously produce RI during a language sample (Miller & Paul, 1995). Therefore, use of elicitation techniques is warranted, providing children who may be *competent* RI producers more opportunities to actually *perform* the productions. Indeed, while the main goal of using elicitation techniques was to insure that each participant had at least 8 opportunities to produce an RI during each session, a secondary intent was to draw the participant into a shared interest and activity. As such, inclusion of elicitation techniques seems warranted during assessment of this social-communicative behavior.

Although within subgroup comparisons of the ASD-HI and ASD-LOW subgroups revealed similar performance across SA1 and SA2 for both subgroups, the between (sub)group comparison of the ASD-LOW subgroup and the TDP group was of greater import and interest. As aforementioned, children in the ASD-LOW subgroup demonstrated significantly fewer productions of RI during SA1 than the TDP group; however, both performed similarly during SA2.

The SA1 session was the only session that did not include availability of highly-preferred objects/activities and was also the only session during which children in the ASD-LOW subgroup produced significantly fewer RI than the TDP group. In other words, not only during SA2, but also during *all sessions* that included availability of highly-preferred objects/activities, children in the ASD-

LOW subgroup performed similarly to typically-developing peers. This suggests that inclusion of highly-preferred objects/activities provided this subgroup of children with ASD a *motivating* joint attention reference that may have promoted increased shared interest with peers, and ultimately increased production of RI. For more able children with ASD who are low RI performers, manipulation of just one environmental factor (in this case object/activity choice) pushed their performance to the level of typical peers. As such, during assessment, and most likely intervention, use of this simple contextual manipulation may provide more accurate information regarding a child's ability to produce RI.

In a broader context, because production of RI serves an important role in conversation (initiation and maintenance, communicative reciprocity) (Tager-Flusberg, Paul, & Lord, 2005), an increase in production of RI may result in increased communication for these children. This supports previous research indicating that inclusion of highly-preferred objects/activities within treatment may increase social interaction skills (Morrison et al, 2000; LeGoff 2003) and improve generalization of target skills (Baker et al, 1998).

Physical Setting. The contextual variable of physical settings (treatment room and classroom) was manipulated across the two DA sessions to determine the possible effects on RI production. Previous research indicates that children with ASD demonstrate improved performance when presented with stimuli in settings where visual and auditory distractions are minimal and the child interacts with only one or two individuals (e.g., treatment room), as compared to “busy”, somewhat distracting, settings where the child may interact with a number of peers and adults (e.g., a classroom). Indeed, when teaching a child with autism a new skill or targeting improvement of a previously acquired skill, current practice would indicate preference for intervention within the least distracting setting and a limited number of communication partners.

The treatment room used in the DA2 session was a setting where the participant interacted with only the principal investigator and one other peer in a quiet room that had no physical distractions (e.g., nothing on the walls). Whereas, the classroom used in DA1 was the participant’s regular classroom setting; any peer who wished to join the participant’s activity was welcome and the typical Kindergarten or First Grade visual and auditory stimuli were unchanged. Therefore, it was anticipated that children in the ASD subgroups would demonstrate increased production of RI within the treatment room (DA2) as compared to the classroom (DA1) setting. Interestingly, the results did not support this hypothesis; children in both ASD subgroups demonstrated similar performance across both physical settings (this held for the TDP group as well).

Two possible explanations are presented for these findings. First, the consistent structure across DA sessions may have provided the more able children with ASD with the support necessary to facilitate performance within the distracting setting (the classroom). Recall that during DA sessions, participants were first provided 5-minutes of "free-play" during which the principal investigator did not present any elicitation techniques. Following this free-play period, the principal investigator began presenting elicitation techniques within the natural framework of the participant's current activity. During both DA sessions, peers were included in the assessment activities and the principal investigator's use of the linguistic cueing hierarchy was constant. Therefore, although the settings were dissimilar, the similar structure of the sessions may have provided more able children with ASD the support necessary to assist them in organizing their expectations for the interaction. Establishing clear expectations and predictable interactions has been shown to facilitate the performance of children with ASD (Wetherby & Prizant, 2001; Quill, 2000).

Second, production of RI is a social-communicative behavior that relies upon the availability of responsive communication partners and interesting objects in the environment (Schwabe et al, 1986); therefore, the classroom (which provides these things) may be an appropriate setting in which to elicit and facilitate this particular skill. However, evaluating and teaching novel skills and/or those that are not intrinsically social (e.g., academic skills, fine motor skills) within a less-distracting environment may still be indicated with this population.

Given the common clinical and educational practice of assessing and treating communication targets of children with ASD within least distracting settings, this finding has clinical implications. More able children with ASD may not require ‘pull-out’ from the classroom in order to obtain an accurate picture of their social-communicative behaviors, particularly production of RI. And if ‘pull-out’ is utilized to assess or treat social-communicative behaviors, inclusion of familiar peers in intervention activities may increase opportunities to demonstrate social-communicative behaviors and promote performance that is similar to classroom performance. In fact, many researchers have targeted improvement of the social-communicative behaviors of children with ASD by including the active involvement (and training) of peers (Pierce & Schreibman, 1997; Goldstein & Cisar, 1992; Haring & Breen, 1992). A number of peer-mediated interventions have described success in increasing the social interaction skills and perception of social competence of children with ASD (for review, see McConnell, 2002).

Linguistic Variables

During both DA sessions, a linguistic cueing hierarchy was employed to determine the influence of cueing on production of RI by the ASD subgroups and the TDP group. The cueing hierarchy, modeled after the graduated prompt approach used by Campione and Brown (1984), provided verbal prompts that graduated from least supportive (spontaneous production) to most supportive (direct cue).

As part of the study, the ASD-HI subgroup completed the dynamic assessment condition to examine the effects of the linguistic cueing hierarchy on performance. However, because this subgroup actually demonstrated similar performance to the TDP group during the static assessment condition, in a clinical or educational setting further dynamic assessment of the skill would not be warranted. Therefore, discussion of the ASD-HI subgroup's performance during the dynamic assessment condition is limited to comparison between (sub)groups.

Comparison of the average cueing level necessary to facilitate RI productions between (sub)groups, as measured by the session production cueing ratio, allowed for examination of whether more able children with ASD required a higher average cueing level to produce a RI than TDP. Results indicated that children in both ASD subgroups received a similar average cueing level per production as children in the TDP group. In other words, children with ASD did not require a higher cueing level to produce RI than TDP. However, children in the ASD-LOW subgroup required a higher average level of cueing during DA2 than did the ASD-HI group, while cueing levels between the ASD subgroups for DA1 were similar.

This finding suggests that although the ASD-LOW group performed similarly to the ASD-HI subgroup during DA2, with regard to RI production, these children required a higher level of cueing to achieve this performance. Recall that the average level of cueing value corresponds with the values of the linguistic cueing hierarchy. During DA2, the ASD-LOW group received an average cueing level of 3.55, placing their average level of cueing between level 3 (indirect cue) and level 4 (direct cue) on the linguistic cueing hierarchy. The ASD-HI group received an average 2.43 during DA2, placing their average level of cueing between level 2 (peer / adult model) and level 3 (indirect cue). Thus, children in the ASD-LOW subgroup appear to have benefited from the linguistic cueing hierarchy. By taking advantage of the linguistic cues, children in ASD-LOW group were able to perform similarly to both the ASD-HI subgroup and the TDP group with regard to RI production.

Further investigation of the cueing hierarchy revealed that across both DA sessions cueing level 2 (peer / adult model) appeared to be the least effective cue level for facilitating production of RI for the ASD-LOW subgroup. This supports previous research that suggests the mere presence (or model) of typical peers is not enough to improve the performance of children with ASD (McConnell, 2002; Morrison et al, 2001; Goldstein, Kaczmarek, Pennington, & Shafer, 1992). Indeed, the fact that children in the ASD-LOW produced a mean of .25 RI productions during DA1 and zero RI productions during DA2 suggests that these children did not “tune in” to their peers’ RI production models, nor those of the adults in their environment (e.g., teachers, the principal investigator).

For the ASD-LOW subgroup, cueing level 4 appeared to be the most effective. However, the cueing level 3 also appeared to facilitate performance. These findings suggest that use of a linguistic cueing hierarchy may be indicated when assessing the RI productions of RI low-performers (see Assessment Methodologies section for further discussion); however, the cueing hierarchy should not rely on peer / adult modeling as one of the cueing levels. As the ASD-LOW subgroup was unresponsive to this cue level, inclusion in of the cue level in future assessment practices with this population may be inefficient and provide limited information about the child's production of RI. Because cueing level 4 was consistently effective, inclusion of this cueing level, as well as the indirect cue level, within a dynamic assessment cueing hierarchy that provides several prompt levels appears warranted.

Assessment Methodologies

In order to investigate the influence of environmental factors on production of RI, two assessment methodologies were employed: static assessment and dynamic assessment. Analysis of static assessment conditions provided information about the unaided production of RI by more able children with ASD and their typically developing peers. Analysis of dynamic assessment sessions provided information about participants' potential performance when assisted by the principal investigator.

Static Assessment

Static assessment describes a child's *actual* unaided performance. In this study, the static assessment condition was presented at three different times, and thus allowed for a view of actual performance from three different perspectives.

First, the SA1 session allowed for quantification of unaided RI productions in the natural classroom environment by both the ASD subgroups and the TDP group. This allowed for an examination of "baseline" or "baserate" performance in a fairly naturalistic context. Recall, SA1, as the other static assessment sessions utilized elicitation techniques to ensure opportunities for RI productions.

Results of the SA1 revealed the variability of RI production across both the TDP and ASD groups. The performance of the TDP group provided a benchmark from which to compare the performance of the more able children with ASD. Further comparison revealed that RI hi-performers did not demonstrate RI production deficits, as compared to typical peers, while the RI low-performers did. By measuring the unaided performance of a child when provided with typical objects/activities, one gleans a more accurate picture of the child's typical classroom performance; a starting point for determining the need for further assessment and intervention.

Second, the SA2 session provided information about each(sub)groups' unaided productions of RI when highly-preferred objects / activities were made available. As aforementioned, one must be motivated to request information from a communication partner. This session was designed to examine the influence of highly-preferred objects/activities on production of RI. Results indicated that by making available motivating objects/activities children in the ASD-LOW subgroup increased their production of RI to levels comparable with the ASD-HI subgroup and the TDP group. As such, inclusion of highly-preferred objects/activities during assessment of social-communicative behaviors may be indicated to assist in discriminating between those children who demonstrate a true skill deficit (i.e., competence) versus those who demonstrate a performance deficit.

Finally, SA3 allowed for investigation of potential change in unaided performance before and after the dynamic assessment condition. Because dynamic assessment may be used to teach a new skill to a child, as in a test-teach-retest application of the methodology (e.g., Pena, 2000), SA3 provided an opportunity for comparison of performance pre- and post-DA condition. All (sub)groups demonstrated no significant change in production of RI from SA2 to SA3. This finding suggests that both subgroups of more able children with ASD were not *learning* a new skill during the DA condition, but rather they were facilitated in demonstrating their previously acquired skill.

The results of the three SA sessions provided essential information about the nature of RI production that was independent of the dynamic assessment condition. Within a clinical context, use of static assessment methods to measure a target child's unaided performance is critical for determining whether or not the child actually demonstrates an RI production deficit. Static assessment may also be used to monitor progress during intervention. By comparing the target child's unaided performance during intervention to his/her pre-treatment performance (and to that of typical comparison peers), the clinician can make more informed treatment decisions. These might include determining if treatment on RI is creating changes in a child's performance or whether treatment on RI can be discontinued.

Dynamic Assessment

Dynamic assessment measures a child's *potential* performance by allowing the examiner to manipulate the interaction for the specific purpose of optimizing the child's performance (Vygotsky, 1986/1934). As such, in the current study the DA condition provided information regarding the participants' ability to benefit from manipulation of environmental factors (i.e., contextual and linguistic variables).

Comparison of the two DA sessions (DA1 and DA2) allowed for examination of the influence of physical setting on production of RI. As aforementioned, contrary to expectations, more able children with ASD demonstrated similar performance in both the classroom and treatment room settings.

With regard to linguistic variable manipulations, the current study utilized a graduated prompt procedure (Campione & Brown, 1984); participants were provided linguistic cues following a cueing hierarchy (least supportive to most supportive) in an attempt to facilitate performance. Results indicated that children in the ASD-LOW subgroup produced significantly fewer RI during SA1 as compared to the DA condition.

These findings suggest that although the availability of highly-preferred objects / activities improved their production of RI in relation to typical peers, their within subgroup performance did not significantly improve until they received the linguistic cues during the DA condition. In other words, while the ASD-LOW subgroup appeared to benefit from the availability of highly-preferred objects / activities, it was use of the linguistic cues during the DA condition that tapped into their potential performance. As such, for these more able children with ASD, dynamic assessment provided a more accurate description of their RI production abilities than static assessment alone. And although children in the ASD-HI subgroup did not demonstrate statistically significant differences in performance between SA1 and the DA condition, a trend towards improved performance during the DA condition was observed (see Figure 4.1).

With regard to clinical application, use of dynamic assessment with RI low-performers may provide information regarding their true potential with regard to production of RI. Individual performance on the dynamic assessment may be used to determine which linguistic cues best facilitate production of RI for a particular child; these cueing levels can then be included in an intervention program to target increased RI production as indicated. Because classroom teachers are often accustomed to providing structured levels of support within the classroom, these cueing levels might be incorporated into everyday classroom interactions, thus supporting generalization of the skill. Finally, as indicated above, use of dynamic assessment with RI high-performers is not indicated if static assessment reveals "typical" levels of performance.

Finally, use of dynamic assessment, in conjunction with static assessment, appears to be effective in discriminating whether some more able children with ASD (RI low-performers) demonstrate deficits in RI production competence or deficits in performance. This supports the suggestion by Day, Englehart, Maxwell, and Bolig (1997) that use of both SA and DA methodologies allows clinicians to truly identify the needs of the child. Further investigation in the effectiveness of using DA and SA methods for evaluation of other social-communication behaviors is warranted.

Summary and Future Directions

A summary of the major findings of the study is presented here, as well as a discussion of future research directions.

Major Findings. This study is the first to quantify the production of RI within the natural environment by both more able children with ASD and TDP. By establishing a baseline of performance by TDP, the study has provided a benchmark by which to compare the performance of more able children with ASD. The similar performance of the ASD-HI subgroup to the performance of the TDP suggests that not all children with ASD demonstrate RI production deficits. Indeed, even children in the ASD-LOW group demonstrated levels of RI production comparable to the TDP group following manipulation of a contextual variable (object/activity choice).

Another interesting finding was that both subgroups of children with ASD demonstrated no significant differences in production of RI across physical settings (classroom and treatment room). This suggests that assessment of social-communicative behaviors, such as RI, may be completed within the natural environment (e.g., classroom) with valid results; “pull-out” for assessment and intervention of this skill may not be necessary. This contradicts current clinical practice.

Finally, low RI performers appeared to benefit from use of linguistic cues during the DA condition. While the peer / adult model did not facilitate production of RI, both the indirect and direct cues appeared to be effective prompts. And although the ASD-LOW group demonstrated an increase in RI productions with the introduction of highly-preferred object /activities, it was not until they received the linguistic cues during the DA condition that their true level of performance was observed. Thus, for this subgroup, the combination of SA and DA assessments assisted in distinguishing between the children's competence and their performance.

However, these findings must be tempered with the limitations inherent in a small sample size. This became a particular limitation given the performance variability among the ASD children, and the need to examine subgroups (high and low RI performers). Additional statistical differences in performance among ASD subgroups and the TDP group may not have been detected given the statistical power of the current sample size.

In addition, one potential methodological limitation of the current study was the inclusion of adults as communication partners when measuring RI productions by both groups of children. Recall that RI productions directed at both peers and adults were coded and included in the data analysis. This inclusion was intentional in an effort to record an accurate picture of the general RI production skills of both more able children with ASD and their typical peers. However, further investigation of RI productions directed specifically toward peers is warranted to determine if more able children with ASD direct a greater number of RI productions to adults than to peers, perhaps contributing to their teachers' overall perceptions of RI production deficits and social communication difficulties.

Future Directions. As motivation clearly plays a role in performance, use of assessment techniques and/or materials that may increase motivation might provide a more accurate picture of the child's potential performance. Overall results of this study suggest that use of highly-preferred objects / activities may increase participants' motivation to produce RI. Further investigation of the types of RI productions made by more able children with ASD may provide additional insight into the whether the children's RI productions were socially motivated or self-serving.

The current study also provides a framework for further investigation of the social-communicative behaviors of children with ASD. Given the importance of context in many social-communicative behaviors, a systematic investigation of the role of environmental factors that may influence performance of such behaviors is warranted. Specifically, examination of the contextual and linguistic supports that may facilitate use of behaviors that contribute to the child's overall appearance of social competence (e.g., self-initiations, conversation skills; Conroy & Brown, 2001) can inform development of assessment and treatment methods.

Current assessment methods and treatment curricula have the potential to overlook important environmental factors that influence performance, which can lead to inaccurate assumptions about children with ASD. Indeed, for a population of children that may show “no interest or ‘appetite’ for interacting with others at any level or by any means, including language” (Tager-Flusberg, 2000; p. 315), one must go beyond their actual performance to tap into their potential performance.

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APPENDIX A: Operational Definitions

Coding

Request for Information Initiation

A ***request for information*** is defined as a demand or question requiring only *information* from a peer or adult (e.g., “How are you?” “What’s that?”). Coding of RI is NOT contingent upon the communication partner’s response. Extensive interpretation of the *intent* of the speaker is to be avoided – please refer to RI types on page 3 for additional examples.

A ***RI*** occurs when a participant demonstrates a *request for information* upon:

- Entering a new peer group,
- Changing conversation topics, - OR -
- Following 3 seconds of non-interaction between ongoing interactions when already in close physical proximity to peer(s) or adults (Koegel et al, 1999b).

Please note: Echolalic speech is not considered an initiation attempt (Koegel et al, 1999b).

(1) Opportunity

<u>Elicitation Opportunities</u>

Elicitation: Coded when one of the following elicitation opportunities is provided to the target child. The target child DOES NOT have to produce an RI in order to code the OPPORTUNITY.

<u>Box Elicitation</u>

- Clinician shows target child box

- Clinician shakes box and looks at child
- Clinician ensures that target child has seen the box
- Clinician places box on table

Missing Piece Elicitation

- Clinician presents game or puzzle to children
- Clinician holds back at least one piece

Irrelevant Object Elicitation

- Clinician presents game (either clinician's choice or child's choice) that has irrelevant object (e.g., Glue stick in card game box)
- Clinician directs child to open game
- If child does not appear to see irrelevant object, clinician will draw child's attention to object

Envelope Elicitation

- Clinician shows target child envelope/bag decorated with stickers
- Clinician looks inside the envelope/bag and looks at child
- Clinician ensures that target child has seen the envelope
- Clinician places envelope/bag on table

Object of Interest Elicitation

- Clinician observes child to determine object to which child is attending
- During a period when the child is not attending to the object, clinician will remove object from table

<u>Manipulation Elicitation</u>

- Clinician will present child with object that requires some kind of manipulation to make it work
- This object may be in combination with one of the elicitation objects above

<u>Natural Opportunities</u>

Natural: Coded when the one of the opportunities below occurs within the context of the assessment.

<u>Spontaneous Production</u>

Coded when the target child initiates a spontaneous request for information from either a peer or adult.

<u>Peer Model</u>

Coded when a peer who is actively playing with the target child produces a request for information initiation related to:

- the current activity;
- the current topic; - OR –
- in response to an elicitation opportunity.

When a peer requests personal information of the target child that is not related to the situations described above, this is NOT considered a peer model.

For example: While playing with blocks, if a peer asks the target child “Are you allergic to peanut butter”, this will not be coded as a Peer Model opportunity.

DO NOT code Peer Model opportunities during ‘free choice play’ portion of all Static Assessment conditions.

Contextual Relevance

Coded when a contextual variable or cue occurs that would be expected to elicit a request for information by a typically-developing child.

For example: When completing a puzzle, the clinician provides a clue for what a piece means or where a piece will fit; the next time the child needs information regarding the content or placement of a piece, one would expect that the target child would ask the clinician or peer. A request for help, or a request to have the clinician perform the action is NOT considered a request for information.

DO NOT code Contextual Relevance opportunities during 'free choice play' portion of all Static Assessment conditions.

Cueing Hierarchy

No prompts: Coded when the target child receives no cues (e.g., natural interactions among target child, peers & teachers)

Adult or peer model: Coded when the clinician or a peer provides a verbal model of a request for information. (e.g., "I have red, what color do you have Billy?" - or – "I wonder what color Billy has."). Please note: This is coded even if the model is not directed at the target child, as long as the target child was in the proximity to hear the model.

Adult indirect cue: Coded when the clinician states that the target child may request information (e.g., "You could ask Billy what color he has")

Adult direct cues: Coded when the clinician specifically directs the target child to request information (e.g., "Say 'what color do you have Billy?")

(2) Request

Coded when target child asks question of peer or adult that requires informational response. This DOES NOT include requests for action (e.g., "Will you help me?", "Do you want to play with me?") or objects (e.g., "Can I have the blue marker?")

Request for Information Type

Request for Information type refers to what question form was used by the target child to request information. Please note: the form may be embedded into a statement (e.g., "I wonder where the brown dog is").

- What – coded when child requests information (RI) using 'what' form
- Where – coded when child RI using 'where' form
- Who – coded when child RI using 'who' form
- When – coded when child RI using 'when' form
- How / How many – coded when child RI using 'how' or 'how many' form
- Why – coded when child RI using 'why' form
- Y/N – coded when child RI using form that requires a Y/N answer for information (e.g., "Do we need to color the eyes?") – NOT for action or object (e.g., "Do you have the red truck?")
- Other – coded when child requests information using form different from those listed above

***** One-word utterances DO NOT count as initiations.***

Communication Partner

Coded to indicate to whom the target child directs the request for information (either a peer, adult, or the group) involved in the activity/interaction.

Please note: the communication partner does NOT necessarily have to be the person who provided an RI model.

(3) Response

Coded to indicate the success of the RI attempt; this code is based on the communication partner's response to the RI.

Success: Coded when the adult or peer who was the target of RI responds to the RI; this response may be verbal or nonverbal.

Unsuccessful or Unclear: Coded when the adult or peer who was the target of RI does not respond to the RI –OR- the response was unclear.

APPENDIX B: Coding Sheet

(1) Opportunity							**(2) Request**								**(3) Response**
	TimeCode	**Elicit / Nat.**	**Cueing Hierarchy**				**RI Type**							**Comm. Prtnr**	**Success / Unsuccess. or Unclear**
			Spont	*Model*	*Indirect Cue*	*Direct Cue*	*What*	*Where*	*Who*	*When*	*Why*	*Y / N*	*Other*	*Peer / Adult / Group*	
1		E / N		P / A										P / A / G	S / Un
2		E / N		P / A										P / A / G	S / Un
3		E / N		P / A										P / A / G	S / Un
4		E / N		P / A										P / A / G	S / Un
5		E / N		P / A										P / A / G	S / Un
6		E / N		P / A										P / A / G	S / Un
7		E / N		P / A										P / A / G	S / Un
8		E / N		P / A										P / A / G	S / Un
9		E / N		P / A										P / A / G	S / Un
10		E / N		P / A										P / A / G	S / Un
11		E / N		P / A										P / A / G	S / Un
12		E / N		P / A										P / A / G	S / Un
13		E / N		P / A										P / A / G	S / Un
14		E / N		P / A										P / A / G	S / Un
15		E / N		P / A										P / A / G	S / Un

CURRICULUM VITA

Amy L. Donaldson

EDUCATIONAL BACKGROUND

Washington State University - Pullman, WA
B.A., Speech Communication — May 1993
Gallaudet University - Washington, DC
M.S., Speech-Language Pathology — May 1995
University of Washington - Seattle, WA
Ph.D., Child Language Disorders — Autumn 2005

PROFESSIONAL BACKGROUND

Clinical Fellow, Speech-Language Pathology — 1995
The Speech Path, Modesto, CA
Co-Director, School Programs/ Speech-Language Pathologist — 1995-2000
Associated Learning and Language Specialists, Redwood City, CA
Speech-Language Pathologist — 2004-Present
University of Washington Autism Center, Seattle, WA

CERTIFICATION AND LICENSURE

State of Washington, Speech-Language Pathology License — 2004-Present
ASHA, Certificate of Clinical Competence — 1996-Present
State of California, Speech-Language Pathology License — 1996-Present
State of California, Rehabilitation Services Credential — 1995-Present

HONORS AND AWARDS

Departmental Scholarship — 1993-1995
Department of Audiology & Speech-Language Pathology, Gallaudet University
Outstanding Graduate Student — 1995
School of Communication, Gallaudet University
Bamford-Lahey Children's Foundation Scholar — 2001-2002
Dr. Margaret Lahey, Director

Huckabay Teaching Fellow 2002-2003

Dr. Lesley B. Olswang and Dr. Ilene Schwartz, Mentors; The Graduate School, University of Washington

Gatzert Child Welfare Fellow 2004-2005

The Graduate School, University of Washington

UNIVERSITY TEACHING EXPERIENCE

Teaching Assistant Spring 1995

A&S 210: Speechreading and Communication Strategies, Gallaudet University

Invited Lectures, University of Washington

PHIL 242A: Medical Ethics: Autumn 2003
SPHSC 303: Language Science: Autumn 2002 ; Autumn 2000
SPHSC 308: Social-Cultural Aspects of Communication: Summer, 2004; Summer 2003; Winter 2003; Summer 2002; Spring 2002; Summer 2001; Spring 2001

SPHSC 565: Speech and Language Pathology Proseminar: Spring 2001; Spring 2002

Clinical Supervisor Summer 2002

University of Washington Speech and Hearing Clinic

Teaching Assistant Autumn 2002

SPHSC 536: Assessment of Language Impairment in Children, University of Washington

Predoctoral Teaching Associate Winter & Spring 2003

SPHSC 100: Voice and Articulation Improvement, University of Washington

Instructor Summer 2003

Development and implementation of new University of Washington SPHSC course through Huckabay Teaching Fellowship: *SPHSC 503: Current Issues in Speech and Hearing Sciences* – "Interdisciplinary Approaches to Early Intervention"

Instructor Autumn 2003

SPHSC 500: Clinical Methodology for Documenting Change, University of Washington

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Clinical Supervisor, Child Language Disorders Summer 2004

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RESEARCH EXPERIENCE

Research Assistant 1993-1995
Dr. James Mahshie, Principal Investigator; Gallaudet University, Department of Audiology and Speech-Language Pathology

Research Assistant 2000-2001
Dr. Lesley B. Olswang, Principal Investigator; University of Washington, Department of Speech & Hearing Sciences, Tools for Transformation Grant

National Institutes of Health Trainee 2001-2003
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Research Scientist 2005-Present
Dr. Geraldine Dawson, Principal Investigator; University of Washington Autism Center, Early STAART Early Intervention Project

PROFESSIONAL ASSOCIATIONS AND SERVICE

American Speech-Language Hearing Association 1996-Present
Certified Member

Infants First Early Intervention Member 1996-2000
San Mateo County School District, San Mateo, CA

American Sign Language Instructor, Volunteer 1998-2000
Associated Learning and Language Specialists, Redwood City, CA

Early Intervention Task Force Member 2002-Present
Center on Human Development and Disability, University of Washington

Autism Society of America; Member 2004-Present

Invited Speaker; Autism Spectrum Disorders Parent Group 2004
The Kindering Center, Bellevue, WA

Invited Speaker; Shoreline Cooperative Preschool Parent Group 2004
Shoreline Community College Parent Education Lecture Series

Invited Speaker, Speech-language pathology service providers 2005
Federal Way School District, Federal Way, WA

CONFERENCE PRESENTATIONS

Mahshie, J., Paulus, C., Donaldson, A., & Brandt, F. (1994). Subglottal and laryngeal factors in deaf speakers' control of speech intensity. Poster presented to American Speech-Language-Hearing Association, New Orleans, LA, November.

Donaldson, A.L., Olswang, L.B., Coggins, T.E. (2001). Innovation in clinical-research partnerships: Community collaboration through technology.

Paper presented to American Speech-Language-Hearing Association, New Orleans, LA, November.

Olswang, L.B., Donaldson, A.L., Svensson, L., & Dalton, J. (2002). Seeing is believing: Direct observation of social communication problems in the school. Poster presented to the Ninth International Congress for the Study of Child Language and Symposium on Research in Child Language Disorders, Madison, WI, July.

Donaldson, A.L., Olswang, L.B., & Coggins, T.E. (2002). Social interaction skills of children with autism. Poster presented to the International Meeting for Autism Research, Orlando, FL, November and the American Speech-Language-Hearing Association, Atlanta, GA, November.

Olswang, L.B., Svensson, L., Donaldson, A.L., Beilinson, J., & Coggins, T.E. (2003). Observing social communication in school: Reliability snags and solutions. Poster presented to the American Speech-Language-Hearing Association, Chicago, IL, November.

Donaldson, A.L. & Olswang, L.B. (2004). Assessing self-initiation skills of children with autism spectrum disorders: Dynamic and static assessments. Paper presented to the American Speech-Language-Hearing Association, Philadelphia, PA, November.

Donaldson, A. L., Olswang, L. B., & Coggins, T. E. (2005). Assessing the self-initiation skills of young children with autism spectrum disorders. Poster presented to the Symposium on Research in Child Language Disorders, Madison, WI, June.

Camilleri, B., Donaldson, A. L., Law, J., & Olswang, L. B. (2005). Two clinical applications of dynamic assessment: An international perspective. Paper to be presented to the American Speech-Language-Hearing Association, San Diego, CA.

PUBLICATIONS

Olswang, L. B., Svensson, L., Coggins, T. E., Beilinson, J., Donaldson, A. *(submitted).* Reliability issues and solutions for coding social communication performance in classroom settings. *Journal of Speech-Language and Hearing Research.*